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STORAGE

REPORT OF THE PROCEEDINGS

OF THE

SECOND INTERNATIONAL METEOROLOGICAL CONGRESS AT ROME.

1879.

Published by Authority of the Meteorological Council.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
AND SOLD BY
J. D. POTTER, 31 POULTRY, AND 11 KING STREET, TOWER HILL;
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GENTLEMEN,

I HAVE the honour, as authorised by you, to submit the English Translation of the Report of the Proceedings of the Second International Meteorological Congress held at Rome in the month of April.

Your obedient servant,

ROBERT H. SCOTT.

To the Chairman and Members of
the Meteorological Council.

October 15, 1879.

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REPORT OF THE PROCEEDINGS

OF THE

SECOND INTERNATIONAL METEOROLOGICAL CONGRESS AT ROME.

Protocol of the First Meeting, 14th April, 2h. p.m.

THE CONGRESS held its first meeting at the Ministry of Agriculture and Commerce, Rome, Monday, the 14th April 1879, at 2h. p.m.

Present: His Excellency the Premier, M. Agostino Depretis, the Delegates MM. Aguilar, Auwers, von Bezold, Blaserna, de Brito Capello, Bruhns, Cantoni, Denza, Hann, Hervé-Mangon, Hoffmeyer, Houzeau, Kokides, Lorenz, Mascart, Mohn, Müller, Neumayer, Palmieri, Paugger, Pittei, Plantamour, Pujazon, Rubenson, Salvatori, Schenzl, Scott, Smith, Snellen, Tacchini, Weyprecht, Wild.

MM. Hellmann, Mendeleef, Weihrauch, Zenger.

The members were received by M. Depretis, the Premier, who delivered an address, after which he declared the Congress open.

M. CANTONI, representing the President of the Permanent Committee, expressed the deep feeling of regret felt by the Congress at the circumstances which had prevented M. Buys Ballot from going to Rome.

He requested M. Mascart to read the address which M. Buys Ballot had prepared for the opening of the first meeting.

M. MASCART read M. Buys Ballot's address.

Mr. SCOTT, the Secretary of the Permanent Committee, read the list of the delegates sent to the Congress by the European Governments, and the Government of the United States. (See Appendix I., p. 31.)

The Acting President of the Permanent Committee, M. CANTONI, proposed to the Congress the provisional adoption of the Byelaws drawn up by the Permanent Committee. (Appendix II., p. 32.)

M 958. Wt. 5398.

These Byelaws were adopted, with a reservation suggested by M. PLANTAMOUR, that modifications of them might be proposed and discussed by the Congress.

The PRESIDENT also submitted, for the approval of the Congress, the programme proposed by the Permanent Committee. This programme was adopted. (Appendix III., p. 33.)

Upon the proposal of M. WILD, M. Cantoni was elected President of the Congress, by acclamation.

Upon the proposal of the PRESIDENT, the Congress completed the Bureau, in accordance with paragraph 2 of the Byelaws, by the election of two Vice-Presidents.

M. Wild, of St. Petersburg, and M. Plantamour, of Geneva, obtained the majority of votes.

The PRESIDENT proposed the nomination, by acclamation, of Mr. Scott of London, and Captain Hoffmeyer of Copenhagen, as Secretaries.

The PRESIDENT requested Mr. Scott, Secretary of the Permanent Committee, to read to the Congress the Report of the proceedings of that Committee. (Byelaws, paragraph 5; Programme, Article 2.)

Mr. SCOTT read the report (Appendix IV., p. 37), and laid upon the table a complete series of the printed documents issued by the Permanent Committee since the Congress of Vienna; viz.,—

1. Report of the Vienna Congress (1873) in English, French, and German.
2. Report of the Committee appointed by the Conference at Leipzig (1872) on Meteorological Telegraphy, in English and German.
3. Report of the Maritime Conference, &c. at London, 1874, in English.
4. Report of the Permanent Committee, 1874, in English, French, and German.
5. Report of the Permanent Committee, 1876, in English, French, and German.
6. Supplement to Report No. 5. Letter of M. de Brito-Capello, in English and German.
7. Report of the Permanent Committee, 1878, in English, French, and German.

He stated to the Congress that the majority of the manuscript documents which had been received from time to time by the Committee were sufficiently noticed in its three reports. As to more recent communications he laid them upon the table; viz.,—

1. Dr. Balfour Stewart; letter of 12th December 1878; on question 16 of the Programme.
2. Captain Hoffmeyer; letter of 14th December 1878. Question 23.
3. M. Sohncke; letter of 19th December 1878. Question 25.
4. M. Hildebrandsson; circular of 28th May 1878. Observations of "cirrus" clouds.

5. Mr. Parkinson (sent by M. Wild); letter of 29th July 1878. Observations in the Pacific Ocean.
6. M. Wild; printed letter of 15th February 1879. Succinct Reports on some points of the Programme, &c.
7. M. Rikatcheff; printed communication (March 1879), *Vorschläge an den meteorologischen Congress.*
   A. On maritime meteorology.
   B. On meteorological telegrams.
8. Dr. Mühry; letter of 4th April 1879. On some points of the Programme.
9. Captain George Jinman (of London); letter of 12th April 1879. Respecting his theory of storms, with a copy of his work, "Winds and their Courses."
10. English Alpine Club; letters of 25th February and 3rd March 1879. On glacier observations.
11. The Austro-German Alpine Club; letter of 26th March 1879. On glacier observations.

Upon the proposal of M. Hervé-Mangon, the Congress passed a vote of thanks to the Permanent Committee for the zeal and devotion with which it had carried out the duties entrusted to it by the Congress of Vienna.

The Congress proceeded to the discussion of the Programme.

Upon the proposal of the President, questions 1, 2, 3, 7, 14, and 33 were reserved for examination at the general meetings of the Congress.

The President subdivided the other questions among five committees, viz.:—

I. Organisation; Nos. 8, 12, and 13.
II. Publications; Nos. 4, 5, 9, and 15.
III. Observations and Instruments; Nos. 10, and 16–25.
IV. Telegraphy. Maritime and Agricultural Meteorology; Nos. 6, 27, 28, 29, 34, and 35.
V. Elevated and distant stations; Nos. 11, 26, 30, 31, and 32.

M. Plantamour stated that he was charged by the Swiss Government to request that the subject of seismography might be added to the Programme.

M. Cantoni supported this proposal, which was accepted. This question was referred to Committee III.

M. Blaserna proposed, and the Congress agreed, that M. de Rossi should be admitted to the Congress in order to be able to explain the construction of his seismographic instruments.

On the proposal of M. Pittei, which was supported by M. von Bezold, the question of the compilation of an International Dictionary of Meteorology was referred to Committee II.

M. Wild proposed to the Congress to include also in the Programme three proposals which are referred to in his "Succinct Reports."

The first was contained in a communication by Dr. Hellmann to the *Zeitschrift der osterreichischen meteorologischen Gesellschaft*, March 1879, and "Succinct Reports," p. 2, c. 5.

"Art. 9. I propose, therefore, that the Congress should express the wish that from these documents a universal catalogue of meteorological observations of all countries, viz., name of station, its geographical co-ordinates, list of the different elements observed, and of the years of observation, place of publication, should be prepared and published, and that it should place this task among the works to be executed in common, as indicated by Art. 12.

"I further propose that the Congress, in the same order of ideas, should also place among the latter class of inquiries the preparation and publication of a systematic catalogue of meteorological works of all countries,—including articles in scientific journals—and should invite the central institutions to contribute thereto by drawing up special catalogues for their respective countries according to a common plan."

The second was printed, Succinct Reports, p. 3, c. 11. "Art. 15. In order to facilitate the general adoption of the rules and formulæ for the reduction of barometric observations to the sea level, which we wish to be established, I propose to construct from these formulæ tables which will give easily for consecutive heights above the level of the sea both for the barometric reading and for the temperature observed at the time, the barometric reading corresponding to the level of the sea.

"Further it would be desirable that in accordance with the remarks and proposals recently formulated by Dr. Hellmann (Comparison of the Standard Barometers of St. Petersburg, Dorpat, Helsingfors, Stockholm, and Upsala, and General Remarks on the Reduction of the Barometer to 32° F., *Repertorium für Meteorologie, T. VI. No.* 8, November 1878), fresh tables for the reduction of the barometer to 32° F. should be calculated from the fresh and more precise data that we possess upon the expansion of mercury and brass, both for the metric and the English barometer, and also tables for the conversion of barometric observations expressed in millimetres into English inches and *vice versâ*. The general adoption of such tables would avoid the vexatious differences presented by the different tables hitherto used."

Both these propositions were referred to Committee II.

The third was printed, Succinct Reports, p. 4, Article 18. "I propose to include observations of the surface temperature of the soil among the elements to be observed at stations of the second order."

This proposal was referred to Committee III.

Capt. HOFFMEYER proposed the question of observations of upper clouds (cirrus) according to the plan of M. Hildebrandsson of Upsala; he expressed his satisfaction that the subject had been already mentioned in the Report of the Permanent Committee.

The question was adopted and referred to Committees II. and III.

On the proposal of Mr. SCOTT, the Congress unanimously adopted the following resolution:—

"The International Meteorological Congress of Rome, at its

first meeting, has instructed its Secretaries to convey to the family of M. Dove the deep regret it feels at the death of that illustrious physicist, who has so greatly contributed to the progress of meteorology."

The Congress proceeded to the election of the Committees, who were constituted as follows:—

Committee I.

Organisation:—Questions 8, 12, and 13.

President - M. Wild.
Secretary - M. Bruhns.
Members - M. Auwers.
„ Hervé-Mangon.
„ Plantamour.
„ Rubenson.
„ Scott.
„ Smith.
„ Tacchini.

Committee II.

Publications:—Questions 4, 5, 9, and 15. Cirrus observations; Dictionary; Catalogue; Tables of Reduction.

President - M. Blaserna.
Secretary - M. Hann.
Members - M. Aguilar.
„ Bruhns.
„ Hellmann.
„ Pittei.
„ Scott.
„ Wild.

Committee III.

Observations and Instruments:—Questions 10, 16 to 25:- - Seismography; Observations of the surface temperature of the soil.

President - M. Mascart.
Secretary M. von Bezold.
Members - M. Cantoni.
„ Capello.
„ Hozeau.
„ Mendeleeff.
„ Mohn.
„ Palmieri.
„ Scheuzl.
„ Snellen.
„ Wild.

Committee IV.

Telegraphy, Maritime Meteorology, Agricultural Meteorology: —Questions, 6, 27, 28, 29, 34, and 35.

President - M. Neumayer.
Secretaries - MM. Müller and Brault.
Members - M. Bruhns.
„ Capello.
„ Denza.
„ Hann.
„ Hoffmeyer.
„ Lorenz.
„ Mascart.
„ Myer.
„ Pittei.
„ Pujazon.
„ Salvatori.
„ Scott.
„ Wild.

Committee V.

Elevated and distant stations:—Questions 11, 25, 30, 31, and 32.
Observations on the variations of glaciers.

President - M. Denza.
Secretary - M. Weyprecht.
Members - M. Hann.
„ Hoffmeyer.
„ Mendeleeff.
„ Mohn.
„ Neumayer.
„ Plantamour.
„ Scott.
„ Wild.

The President proposed for the first meetings of the different Committees—

I.	Tuesday, 15th	-	-	-	9h. a.m.
II.	„ „	-	-	-	2h. p.m.
III.	„ „	-	-	-	11h. a.m.
IV.	„ „	-	-	-	4h. a.m.
V.	Wednesday, 16th		-	-	9h. a.m.

The President, in reply to M. Snellen, announced that the meetings of the Committees would be posted up in the Ministry.

The next general meeting was fixed for Thursday, 17th, at 9h. a.m.

The PRESIDENT announced the order of the day

Question 3.
Question 7.
Question 33.

The meeting rose at 5h. 30m.

Confirmed at the meeting of the 17th.,

G. CANTONI.

Protocol of the Second Meeting, 17th April 1879, at 9h. 30m. p.m.

Delegates present: MM. Aguilar, Auwers, von Bezold, Blaserna, Brault, de Brito Capello, Bruhns, Cantoni, Denza, Hann, Hervé-Mangon, Hoffmeyer, Houzeau, Kokides, Lorenz, Mascart, Mohn, Müller, Neumayer, Palmieri, Paugger, Pittei, Plantamour, Pujazon, Rubenson, Salvatori, Schenzl, Scott, Smith, Snellen, Tacchini, Weyprecht, Wild.

MM. Hellmann, Mendeleef, Weihrauch, Zenger.

The PRESIDENT requested the Secretary to read the protocol of the first meeting, which was adopted.

The PRESIDENT read to the Congress a telegram which he had just received from M. Majorana Calatabiano, Minister of Agriculture, Commerce, and Industry :—

"I beg that you will convey to the honourable members of the International Meteorological Congress the expression of my gratitude to them for their participation in the Congress of Rome, a participation which is equally honourable for themselves and for the science which they cultivate.

"I have much regretted not having been able to be present at the opening of the Congress, having been prevented by circumstances over which I had no control.

"I hope, however, to be able to be there before their departure, in order to have the pleasure of personally expressing to them my sentiments of gratitude."

Upon the proposal of M. PLANTAMOUR, the Congress requested the President to send to the Minister the following message :—

"MONSIEUR LE MINISTRE, &c.

"The Congress has received with most sincere gratitude the telegram by which you welcome it to Rome, and in which you express the interest that you take in its labours.

"The Congress requests me to express to you their acknowledgments, and the hope that they will see you at Rome before the end of the meetings.

"G. CANTONI,
"President of the Congress."

The Secretaries announced the receipt of the following documents :—

A letter from M. Marié-Davy, of April 11, 1879. Referred to Committee III.

A letter from Baron Friesenhof, of November 4, 1878. Referred to Committee IV.

A letter from Mr. J. Allan Broun, of April 7, 1879. Referred to Committee V.

M. DE BRITO-CAPELLO presented to the Congress several copies of the publications of his observatory, viz. :—

A. Resumé of the different meteorological elements observed at the Observatory of the Infante D. Luiz during 20 *years* (1856–1875).

B. Temperature of the air at Lisbon, calculated in 5*-day means, during* 20 *years* (1856–1875). *Annual and diurnal variations, calculated by Bessel's formula.*

C. Atmospheric pressure at Lisbon for 5*-day means, during* 20 *years* (1856–1875). *Annual and diurnal variations, calculated by Bessel's formula.*

D. Rainfall at Lisbon during 40 *years. Observations by M. Franzini, from* 1836 *to* 1855, *and the continuation at the Observatory of the Infante D. Luiz, from* 1856 *to* 1875.

E. Atmospheric electricity during 1877 *and* 1878. *Annual and diurnal variations.*

F. Meteorological résumé for Portugal.

Upon the proposal of the PRESIDENT and other members, the Congress invited the following gentlemen to the meetings :—

The Prince of Teano, President of the Geographical Society.

M. Bodio, Director of the Statistical Department.

M. Cannizzaro, Professor of Chemistry, and President of the Italian Commission of Weights and Measures.

M. Cecchi, Profes-or and Director of the Ximenian Observatory at Florence.

M. C. Correnti, First President of the Geographical Society.

M. Giordano, Director of the Geological Committee.

M. Govi, Professor of Physics at the University of Naples, and member of the International Committee of Weights and Measures.

M. Grassi, Assistant at the Central Meteorological Office.

M. Miraglia, Director of the Department of Agriculture.

M. Pisati, Professor of Physics, and Member of the Italian Commission of Weights and Measures.

M. Respighi, Director of the Observatory of the Capitol.

M. Sella, President of the Academy "dei Lincei."

The discussion on Article 3 of the Programme was opened :—

"Report on the conformity with each other, and with the decisions of the Congress of Vienna, of instruments, methods of observation, and publication of observations in the different countries."

M. WILD proposed that the preparation of this Report should be referred to the future International Committee.

The PRESIDENT seconded this proposal, observing that this Report, which was to have been drawn up Dr. Jelinek, had not been presented to the Congress owing to the lamented death of that distinguished meteorologist.

Mr. SCOTT drew the attention of the Congress to the fact that, with regard to the European systems, the Report presented to the British Parliament in 1877* contained much useful information on question 3.

Finally the Congress adopted the following resolution :—

"*The Congress decides that the English Report mentioned by Mr. Scott be translated into French and German, and published as Appendix V. to the Report of the present Congress. At the same time it requests the future Committee to make such a Report for the next Congress, respecting the conformity of methods, &c. with the decisions of the Congresses of Vienna and Rome.*"

The Congress proceeded to the discussion of question 7.

" The Committee is of opinion that it is impossible at present to compile general instructions adapted in their details to the special peculiarities of all countries and all climates. It proposes, therefore, that the Congress should confine itself, in the case of anyone demanding typical instructions, to designating those of the existing instructions which are most conformable to the decisions of the Congress."

M. WILD proposed, as a modification of the latter portion of question 7, that the directors of central institutes who might be present should be invited to inform the Congress whether their instructions were in conformity with the regulations of the Congress of Vienna.

This proposal was adopted by the Congress, and the PRESIDENT requested from the Directors of the Central Institutions who were present preliminary information as to the degree of conformity of their instructions with the said resolutions.

M. MASCART declared that, as regards France, he would endeavour to follow as closely as possible the rules laid down at Vienna.

M. Aguilar considered the alteration of old rules as to observations, &c. serious, but he was ready to follow, as far as possible, the regulations made at Vienna.

As to the other systems of Europe, the directors whose names are given in the following list, announced that their instructions were in general conformable to the regulations of Vienna :—

MM. v. Bezold	for	Bavaria.
Houzeau	,,	Belgium.
Hoffmeyer	,,	Denmark.
Scott	,,	England.
Neumayer	,,	Germany (Deutsche Seewarte).

* Report of the Treasury Committee appointed to inquire into the conditions and mode of administration of the Annual Grant in aid of Meteorological observations. London, 1877, Appendix VIII.

MM.	Snellen	for Holland.
	Cantoni	„ Italy.
	Mohn	„ Norway.
	Capello	„ Portugal.
	Wild	„ Russia.
	Bruhns	„ Saxony.
	Rubenson	„ Sweden.
	Plantamour	„ Switzerland.

The Congress passed to the discussion of question 33.

"Should we not recommend the general adoption of a certain first meridian, for example, that of Greenwich, for synoptic charts?"

M. Bruhns proposed that the Congress should recommend the adoption of the same first meridian for all meteorological charts. He was of opinion that the meridian of Paris or Greenwich should be chosen; he preferred the latter, because most meteorologists used it.

M. Pujazon thought that the choice of a similar projection for synoptic charts was of more importance than the choice of a similar first meridian.

He thought that for Spain there would be an inconvenience in abandoning the meridian of San Fernando (Cadiz), as he was opinion that similar difficulties might exist in other countries, he proposed the adoption for synoptic charts of the meridian of the Island of Ferro, in conjunction with the first meridian adopted in each country.

Professor Smith supported the opinion that the choice of a first meridian was not of great importance, and he thought that in this respect the choice might very well be left free to meteorologists.

M. Snellen quoted the opinion expressed by M. Buys Ballot in his "Suggestions," and in the "Sequel to the Suggestions," an opinion which he was glad to find in accord with that of M. Bruhns.

M. Plantamour did not think that it was very important to adopt the same first meridian for all countries.

Captain Hoffmeyer wished for uniformity, in order to facilitate the comparison of different charts with each other.

M. Wild supported the opinion of Captain Hoffmeyer.

M. Mohn thought that the meridian of Greenwich should be adopted, on account of maritime observations for which that meridian is used.

M. Neumayer thought that it would be necessary to choose either the meridian of Paris or Greenwich, but he gave the preference to the latter, in order to facilitate the reduction of maritime observations.

M. Brault did not see the importance of a first meridian for synoptic charts, but he thought that for charts relating to nautical meteorology that of Greenwich was preferable.

Mr. Scott supported the opinion of M. Neumayer. He thought that the meridian of Ferro should be abandoned; that meridian

had been chosen because it made all longitudes for Europe east, but such a meridian did not suit transatlantic countries better than those of Greenwich or Paris.

The PRESIDENT put M. Pujazon's proposal to the vote, viz.:—

"The Congress, while recognising that the general adoption of a certain first meridian would present several advantages for synoptic charts, restricts itself to recommending the insertion of a second scale in which the longitudes are reckoned from the old first meridian of geographers, that of the Island of Ferro."

This proposal was not adopted.

M. MASCART thought that the adoption of the meridian of Paris was necessary for the climatology of France, and that in the proposal of M. Bruhns a distinction should be made between the different kinds of meteorological charts.

M. WILD supported the proposal of M. Bruhns. It was agreed that this proposal should be divided into two parts.

The PRESIDENT put the first part to the vote, viz.:—

"*The Congress recommends the adoption of the meridian of Greenwich as a starting point for the construction of synoptic meteorological charts.*"

This proposal was accepted by the majority.

The PRESIDENT then put the second part to the vote:—

"*In the event of another meridian being used in the construction of meteorological charts, the Congress recommends that an indication should be given upon the chart of the difference of longitude between the first meridian adopted and the meridian of Greenwich.*"

This proposal was unanimously adopted.

The next meeting was fixed for Saturday, 19th April, at 9h. a.m.

The PRESIDENT announced the order of the day.

The Report of Committee No. III. (Instruments and observations.)

The Report of Committee No. I. (Organisation.)

The meeting was adjourned at 11 o'clock.

Confirmed at the meeting of the 19th,

G. CANTONI.

Protocol of the 3rd Meeting, 19th April, at 9h. 45m. a.m.

Delegates present: MM. Aguilar, Auwers, von Bezold, Blaserna, Brault, Bruhns, Cantoni, Capello, Denza, Hann, Hervé-Mangon, Hoffmeyer, Houzeau, Kokides, Lorenz, Mascart, Mohn, Müller, Neumayer, Paugger, Pittei, Plantamour, Pujazon, Rubenson, Salvatori, Schenzl, Scott, Smith, Snellen, Tacchini, Weyprecht, and Wild.

MM. Hellmann, Mendeleef, Weibrauch, and Zenger.

Guests:—MM. Cecchi, de Rossi, Giordano, Govi, Grassi, Miraglia, Pisati, and Respighi.

The protocol of the second meeting was read and confirmed.

The PRESIDENT read the following communication :—

"MONSIEUR LE PRÉSIDENT,

"TO-MORROW, Sunday, at 1h. p.m., there will be a meeting of the Royal Academy *dei Lincei* at the Capitol.

"Those of our colleagues of the Meteorological Congress who may wish to be present will be welcome.

"P. BLASERNA,
"Secretary of the Academy."

The PRESIDENT made the following announcement :—

"From information received at the Ministry of Foreign Affairs, General Myer has not been able to leave America before the 12th April, so that he will not be able to reach Rome before the close of the Congress."

The Secretaries announced the receipt of a letter from Mr. Buchan, dated 14th April 1879, with reference to question 17, *Exposure of Thermometers*, which had been already considered by Committee No. III.

The discussion on the Report of the Third Committee (Instruments and Observations), *Appendix VI.*, p. 69, was opened.

M. MASCART, President of the Committee, read to the Congress its resolutions on the different points which had been submitted to it.

Question 10. "The Committee proposes to have a comparison made of the standard barometers and thermometers of all the Meteorological Institutes, by referring them to a certain barometer and thermometer which, for the time being, appear to be the best verified. Inasmuch as the International Office of Weights and Measures of Paris will be in possession of such verified standard instruments, a comparison should be instituted with them, and they should serve as a basis for all corrections. At the same time any questions about accurate height above sea level of standard barometers should be raised."

Resolution: "*The Congress recommends the directors of all central institutions to have their instruments compared with the standard instruments of other countries.*"

This resolution was adopted.

Question 16: "The Committee proposes the establishment of uniform rules for determining the fixed points of thermometers."

Resolution: "*The Congress is of opinion that the method indicated in M. Pernet's report on the determination of the fixed points of thermometers should be provisionally accepted.*"

This resolution was adopted.

Question 17: "Can definitive rules now be established for the most suitable exposure of thermometers destined to give the temperature of the air?"

Resolution: "*The Congress without actually prescribing a fixed form of thermometer screen suitable for different climates and even for the exigencies of observers, draws the attention of meteorologists to the reports and communications presented to the Congress, either as printed papers, or in the protocols of the meetings of the Committee.*"

This resolution was adopted.

Question 18: "Have additional comparative experiments been made since the First Congress for forming an opinion of the different methods for determining earth temperature which give more definite information as to their relative value?"

M. WILD's proposal for observations of the surface temperature of the soil.

Resolution: "*The Congress has not been informed of any new experiments made on this subject since the date of the Vienna Congress, and, in conformity with M. Wild's suggestion, proposes to include the temperature of the surface of the earth among the meteorological elements to be observed at stations of the second order.*"

This resolution was adopted.

Question 19: "Have decisive experiments been made since the First Congress to find a simple and appropriate method for determining radiation, and what is the relation between this and the amount of aqueous vapour in the atmosphere?"

Resolution: "*The Congress finds that the researches into the subject of radiation are not yet sufficiently advanced to enable it to propose a method of observation, and considers that the question should be referred to the next Congress.*"

This resolution was adopted.

Question 20: "What progress has been made in methods for determining the humidity of the air?"

Resolution: "*The Congress recommends the employment, as far as may be possible, of a regular arrangement for ventilation in the determination of the humidity of the air by means of the dry and wet bulb thermometers.*"

This resolution was adopted.

Question 21: "What progress has been made in the methods of determining evaporation?"

Resolution: "*The Congress points out that atmometers generally should fulfil certain conditions of comparability, and expresses the opinion that there is need of fresh researches being undertaken, for the determination of the form and exposure of the instruments to be employed.*"

This resolution was adopted.

Question 22: "Is there any reason to change, after further experience, the decisions of the First Congress respecting the instruments and methods for measuring the quantity of rain or snow?"

Resolution: "*The Congress thinks that, for stations of the second and third order, a diameter of eight or even of four inches is sufficient for the rain gauge.*"

"*As to the position of the rain gauges, the Congress confines itself to recommending that they should never be placed upon a roof, but that they should be sufficiently elevated to be out of the influence of drifting snow, and of the splashing of drops from the ground, while they must not be sheltered by trees or other neighbouring objects.*"

MR. SCOTT said he was pleased to learn that, in accordance with

the opinions on rain gauges frequently expressed by Messrs. Buchan and Symons, the size of the gauge now proposed was much less than that proposed by the Congress of Vienna.

The resolution was adopted.

Question 23: "How may absolute values of the velocity of the wind be deduced from the direct indications of different anemometers?"

Resolution: "*The Congress does not feel itself prepared at present to reply to the question of the determination of wind velocity. It confines itself to recommending the directors of central institutions to effect a comparison between the anemometers employed in different countries.*"

Captain HOFFMEYER requested that the question might be left to the future International Committee.

Mr. SCOTT called the attention of the Congress to the action taken at Vienna respecting anemometers, where M. Wild's instrument had been recommended for general introduction at stations of the Second Order, while the Committee of the present Congress had not adopted any special resolution upon the subject.

He pointed out to the members of the Congress the importance of preserving as much as possible the continuity of the proceedings of the two Congresses.

M. TACCHINI supported the proposition of Captain Hoffmeyer that the International Committee should be charged with the examination of the question.

M. WILD said that the Committee had made a point of not recommending any special instrument, since the adoption of such a recommendation would imply a judgment on the part of the Congress which might perhaps be inconvenient. For this reason he had recalled the proposal which he had made of indicating the instruments which should serve as starting points for the comparison of the standard barometers and thermometers of the different countries; and he requested the Congress not to have regard to the previous decision of the Congress of Vienna in considering the question which was now before it.

The PRESIDENT remarked that the question resolved itself into two parts:—

1°. Whether the comparison should be made in each country only.

2°. Whether, in addition, there should be an international comparison.

Captain HOFFMEYER renewed his proposal that the Committee should be charged with such a comparison.

Professor SMITH supported the views of MM. HOFFMEYER and TACCHINI, and proposed to add the following resolution:

"*If the future International Committee finds that the question is sufficiently advanced, it will propose an international comparison of anemometers.*"

The PRESIDENT put the proposal of the Committee to the vote, and it was adopted; and afterwards the proposal of Professor SMITH, which was also adopted.

Question 24: "Have since the last Congress better methods been discovered for measuring the ozone in the atmosphere?"

Resolution: "*The Congress thinks that the difficult question of the determination of ozone does not, in its present condition, permit of a definite solution.*"

This resolution was adopted.

Question 25: "What progress have the methods for determining atmospheric electricity made, and what results have observations of this kind furnished hitherto?"

Resolution: "*The Congress is of opinion that the study of atmospheric electricity has made marked progress in recent years, and recommends that a comparison should be made between the instruments which are most generally used.*"

Lastly, on the question of seismometry, which had been referred to Committee No. III. by the Congress at its first meeting, the Congress adopted the following resolution:—

"*After having heard with interest the report on the investigations of M. de Rossi on the phenomena which he comprises under the term 'Endogenous Meteorology,' the Congress expresses its desire to see such researches continued, and insists upon the relations which may exist between them and those of general meteorology.*"

The Congress proceeded to the Report of Committee No. I. (Organisation).

M. Bruhns, Secretary of this Committee, read the Report (Appendix VII., p. 73).

Three questions were referred to the Committee, viz.:—

"8. The Committee proposes to establish, by small annual contributions from all countries taking part in the Congress, an international fund, for the expenses incurred by such joint undertakings as those named in the following sections, and the expenses of postage and printing for the Congress and its Permanent Committee."

"12. The Committee is of opinion that the establishment of an International Meteorological Institute is at present not possible, nor even desirable, and propose to provide for the functions and labours which might devolve upon such an institution in the following manner:—

"(*a.*) The international administrative functions, such as the execution of the decisions of the Congress, the convening of future Congresses, the care of joint international investigations and undertakings, the administration of the international fund, &c. will be confided, as is already partly the case, to a *Permanent Committee* elected from time to time by a Congress, and required to give an account of its action to the next Congress.

"(*b.*) As regards researches which embrace a considerable portion of the globe for the purpose of deducing general laws in meteorology, it is desirable that permanent relations for the communication of materials should be established between the different central institutes, and that the publications appearing in each country should

be distributed gratuitously to all institutes and to all persons who take part in the investigations. These publications are to be, moreover, rendered generally accessible through the agency of booksellers. These international investigations will be based upon the publication of the observations of each country according to the international form, and besides on the special labours which each country may be willing to undertake with regard to its own climate. In the case of supplementary information being required for any countries, it is desirable that a suitable system of reciprocal communications should be devised."

"13. The Committee considers the following subjects as possessing a general interest:—

"(*a.*) The critical collection and discussion of all existing data on the diurnal and annual range of Air Temperature, and attempts to deduce general laws therefrom.

"(*b.*) The critical collection and discussion of all existing data on the diurnal and annual range of Absolute and Relative Atmospheric Humidity, and attempts to deduce general laws therefrom.

"(*c.*) The critical collection and discussion of all data on the diurnal and annual range of the Amount of Cloud.

"(*d.*) Wind tables for the 12 months and for the year.

"(*e.*) Tables of precipitation for the 12 months and for the year.

"(*f.*) New tables of atmospheric pressure, with isobars, for the 12 months and for the year.

"(*g.*) Charts of the movements of storms.

"(*h.*) Daily synoptic charts, embracing considerable portions of the globe."

The Committee proposed the following resolutions:—

"A.—1. *The second Meteorological Congress, assembled at Rome, institutes an* International Meteorological Committee, *which is charged with everything that concerns international relations until the meeting of the next Congress.*

"2. *The Committee is composed of nine members, elected by ballot, under the restriction that two delegates of the same country cannot hold seats on it at the same time.*

"3. *In case of vacancy by the resignation or by the death of one of its members, the Committee may complete itself by the co-option of a new member, having regard to the restriction above indicated.*

"4. *The Committee elects its own executive officers and distributes its labours among the different members.*

"5. *The Committee is charged with seeing that the decisions of the Congress are carried out; with the convening of future Congresses; with the preparation of the questions which should be submitted to this Congress; with the keeping the delegates to the present Congress informed of its proceedings and of its decisions;*

and lastly, with the presentation to the next Congress, at the expiration of its functions, of a report embracing the whole of the period.

" B. *The Congress is of opinion that a new Congress should be convened after a maximum interval of five years.*

" C. *As regards researches which embrace a considerable portion of the globe for the purpose of deducing general laws in meteorology, it is desirable that permanent relations for the communication of materials should be established between the different central institutes, and that the publications appearing in each country should be distributed gratuitously to all institutes and to all persons who take part in the investigations. These publications are to be moreover rendered generally accessible through the agency of booksellers.*

" *The Congress considers the following subjects, among others, as researches having a character of general interest:*

" (a.) *The critical collection and discussion of all existing data on the diurnal and annual range of air temperature, and attempts to deduce general laws therefrom.*

" (b.) *The critical collection and discussion to all existing data on the diurnal and annual range of absolute and relative atmospheric humidity, and attempts to deduce general laws therefrom.*

" (c.) *The critical collection and discussion of all data on the diurnal and annual range of the state of the sky, that is, of the amount of cloud.*

" (d.) *Wind tables for the* 12 *months and for the year.*

" (e.) *Tables of precipitation for the* 12 *months and for the year.*

" (f.) *New tables of atmospheric pressure, with isobars, for the* 12 *months and for the year.*

" (g.) *Charts of the movements of storms.*

" (h.) *Daily synoptic charts, embracing considerable portions of the globe.*

" *The directors of the central institutions are invited to have these works executed as soon as possible for the stations of their respective countries, and published, in order that they may serve as a basis for researches which may be undertaken on the general march of meteorological phenomena over the surface of the globe.*

" *Before undertaking the investigation of any one of the abovementioned subjects, the public establishments are invited to acquaint the President of the International Committee of their intention, and he will inform the directors of all the central institutions.*

" D. *The Congress resolves not to carry out the eighth proposal of the Programme, relative to the formation of a small international fund by means of small annual contributions by all the countries taking part in the Congress.*"

M. Snellen requested the postponement of the consideration of this Report.

This proposal was not accepted.

M. Snellen then proposed the following resolutions:—

1°. " The Congress shall institute an International Office of Meteorology.

2°. "This Office shall consist of a President, assisted by as many salaried *employés* as shall be necessary.

3°. "The Office shall have no initiative nor any legislative power; it shall be charged only with the carrying out of the decisions of the Congress and the preparation of a future Congress. For this purpose it should be in correspondence with the different meteorologists in order that it may know what are their wishes."

M. PLANTAMOUR proposed that a limited Sub-Committee should be nominated, forming part of the General Committee.

M. SNELLEN remarked that a large Committee would find great difficulties in the way of correspondence.

The PRESIDENT put M. Snellen's proposal to the vote, which was not accepted.

The resolution A. 1 of the Committee was adopted.

The Congress proceeded to the consideration of No. A. 2.

Captain HOFFMEYER inquired the reason for selecting only nine members.

M. WILD explained that the Committee had wished to include the directors of the central institutions of all the great countries.

Captain HOFFMEYER made the following proposal:—

"The International Committee of Meteorology shall be composed of all the directors of the independent meteorological systems of the different countries."

Mr. SCOTT remarked that it was impossible to define with precision the expression "independent systems," and reminded the Congress that there were several independent meteorological systems in the British Isles.

M. PLANTAMOUR did not oppose the increase of the number of the members of the Committee, but he also considered the expression of "independent systems" too vague and ambiguous.

M. VON BEZOLD thought that a numerous Committee would work slowly.

Captain HOFFMEYER was of a different opinion, as all the directors would be members of the Committee.

M. SNELLEN proposed that the Committee should be composed of three members only.

This proposal was not accepted.

The proposal A. 2 of the Committee was adopted.

Proposals A. 3–5, B., C., and D. of the Committee were put to the vote successively by the President and adopted.

The next meeting was fixed for Monday the 21st, at 10h. a.m.

The PRESIDENT announced the Order of the Day:—

1. Election of the members of the International Meteorological Committee.
2. Report of Committee No. II. (Publications.)

The Meeting was adjourned at noon.

Confirmed at the meeting of the 21st.

G. CANTONI.

Protocol of the Fourth Meeting, 21st April 1879, at 10h. 15m. a.m.

Delegates present: MM. Aguilar, Auwers, von Bezold, Blaserna, de Brito Capello, Bruhns, Cantoni, Denza, Hann, Hoffmeyer, Houzeau, Kokides, Lorenz, Mascart, Mohn, Neumayer, Pittei, Plantamour, Pujazon, Rubenson, Salvatori, Scott, Smith, Snellen, Tacchini, Weyprecht, and Wild.

MM. Hellmann, Mendeleef, Weihrauch, Zenger.

Visitors: MM. Cecchi, de Rossi, Grassi, Pisati, Respighi.

Commander Majorana-Calatabiano, Minister of Agriculture and Commerce, entered the hall of the Congress. The President introduced to him all the members who were present. The Minister expressed his lively satisfaction at his having been able to make the personal acquaintance of the distinguished foreign delegates who had honoured the Congress at Rome with their presence. He added that he knew that their counsels and their labours would be very beneficial to the progress of meteorology, and especially to the important applications to which that science may give rise.

The PRESIDENT replied that he conveyed the deep sentiments of gratitude of all the foreign delegates for the general hospitality which they had received at Rome from the Government and from the country.

The protocol of the third meeting was read and confirmed.

The PRESIDENT, in the name of M. Bodio, Director-General of Statistics, presented to the Congress a copy of a work which had just appeared and of which he intended to send copies to all the members of the Congress:—*Monografia della Città di Roma e della Campagna romana, presentata all' Esposizione universale di Parisi nel* 1878. *Parte prima e seconda con atlante. Roma, tipografia Elzeviriana.*

M. PLANTAMOUR expressed the thanks of the Congress for this liberality.

Mr. SCOTT announced the receipt of a work entitled:—*Indice metodico della monografia degli strumenti meteorologici, compilata dal dottore Isidoro Pistolesi, colla tavola degli autori e l'alfabeto degli strumenti. Pisa, presso Rocco Vannucchi,* 1845.

In the absence of the author, M. MASCART laid upon the table a printed list entitled:—*Travaux de Météorologie nautique entrepris au Dépôt des Cartes et Plans de la Marine française sous la direction de L. Brault, lieutenant de vaisseau, chef du service météorologique.*

The Congress proceeded to the election of the members of the International Meteorological Committee.

M. BRUHNS proposed that the voting should not be by countries, but that the names of the delegates present should be called. He further proposed that it be permitted to add the names of absent meteorologists, for instance, of M. Buys Ballot; for himself, however, he absolutely declined to be nominated.

M. WILD asked whether all meteorologists could be elected; even those who are not delegated by their governments to attend the Congress.

M. BRUHNS was of opinion that only those delegates who had been prevented from attending were eligible.

M. Snellen announced that M. Buys Ballot would not accept a nomination to the Committee, from considerations of principle.

M. Mascart thought that the Congress should not take such a reservation into account, and hoped that in the interest of the science, M. Buys Ballot would accept the functions which the Congress would not fail to entrust to him.

The President requested MM. Mohn and Snellen to act as scrutineers.

The scrutineers having collected the votes, declared that according to the voting of the Congress the Committee was composed of the following members:—

MM. Buys Ballot, Cantoni, de Brito Capello, Hann, Mascart, Mohn, Neumayer, Scott, Wild.

The Congress passed to the discussion of the report of Committee No. II. (Publications.)

M. Blaserna, President of the Committee, read the report (Appendix VIII., p. 74), upon questions 4, 5, 9, and 15, and also upon observations of upper clouds and the compilation of an international dictionary of meteorology.

Question 4: "Report of M. Buys Ballot on the methods employed in the different countries for obtaining true daily means from the various combinations of hours of observation.

Resolution: "*The Congress proposes that each country be invited to establish at a certain number of points, regard being paid to local conditions, stations at which continuous observations should be made by means of self-recording instruments, or else hourly observations during several term-days in each month, or lastly continued, equidistant, and frequent observations (eight times a day at least), in order to obtain the necessary data for reducing to true means the means of observations made twice or thrice a day at ordinary stations.*"

This resolution was adopted.

Question 5: "The Committee proposes the general adoption of the forms of publication already introduced in several countries for observations at a certain number of stations of the second order, chosen in each country as international stations. (See the reports of the Committee for the years 1873 and 1874, 3rd meeting at Utrecht, and Appendix F.)"

Resolution: "*The Congress adopts for the observations of a certain number of stations of the second order, chosen as international stations, the form of publication proposed in* 1874 *by the Permanent Committee of the Vienna Congress and printed in its report for that year.*"

This resolution was adopted.

Upon the question as to the information published with regard to Wind, M. Weihrauch has made a communication on the subject, in relation to which the Committee proposed the following resolution:—

"*The monthly and yearly resumés published by the central offices for the different stations contain, in accordance with the resolutions of the Congress of Vienna, a summary of the frequency of the eight principal directions of the wind, both for the months and for the*

year. Seeing the importance which must be attached not only to the direction but also to the force of the wind, the Congress proposes to publish also in these summaries the mean force of each wind, and for the greatest possible number of stations for each month and for the year. Where the form adopted allows sufficient space, the figures representing the frequency and the mean force should be placed side by side, otherwise it is preferable to give both in the form of an appendix."

M. RUBENSON remarked that sufficient space could not be found in the international form.

M. BLASERNA explained that there was perhaps space in the form adopted for the Italian stations; if the directors of other institutions could not find space, the indications of wind force might be given in an appendix.

The resolution was adopted.

Question 9: "The Committee requests the delegates to prepare for the Congress at Rome a catalogue of the meteorological observations, both published and unpublished, in their respective countries."

M. HELLMANN proposed to add thereto the publication of a catalogue of works and memoirs respecting meteorology.

Resolution: "*The Congress states with pleasure that very valuable preliminary work corresponding to article No. 9 of the Programme and to M. Hellmann's proposal has been already partly executed. But as it is to be desired that these materials should be collected in a general catalogue, the Congress proposes that these publications be divided into two categories:—*

"1°. *A catalogue of series of observations.*

"2°. *A catalogue of meteorological works and memoirs.*

"*As to the first category, the Directors of the different Meteorological systems are invited to prepare catalogues of the published and unpublished observations in their respective countries, and to inform the International Committee of the work already done in that direction.*

"*As to the second category, the Congress is of opinion that the works already done by Professor Cleveland Abbé, and the catalogues already printed of the library of the Meteorological Society of London and of that of the Observatory of Brussels, might well serve as a starting point for more comprehensive publications, and invites all the directors of other meteorological libraries to add the list of works and memoirs which are not yet entered in these catalogues.*"

M. HOUZEAU placed upon the table a copy of the *Catalogue des ouvrages d'astronomie et de météorologie qui se trouvent dans les principales bibliothèques de la Belgique, préparé et mis en ordre à l'observatoire royal de Bruxelles; suivi d'un appendice qui comprend, tous les autres ouvrages de la bibliothèque de cet établissement* (Bruxelles, F. Hayez, Printer of the Royal Academy, 1878).

M. WILD announced that for Russia there already existed a catalogue for published observations, viz., *Catalogue des Observations météorologiques en Russie dressées par F. Claver*, and published in 1872 in the *Repertorium für Meteorologie*, T. II. The Central Physical Observatory of Russia intended to publish shortly a supplement to this catalogue.

As to the unpublished observations which exist in the archives of the Central Physical Observatory, it was also intended to publish a catalogue shortly.

M. NEUMAYER announced that the German Government had purchased for the Deutsche Seewarte the library of the late Professor Dove, of Berlin. A complete catalogue of this library was now being prepared, and would be presented to the International Committee.

The resolution was adopted.

As to the question of an international dictionary, proposed by M. PITTEI, the following resolution was adopted:—

"*The Congress is of opinion that it would be very useful that an international dictionary of meteorology should be published.*"

Question 15: "The Committee recommends the establishment of rules and formulæ for reducing barometric readings to the sea level in a uniform manner."

The Congress, in accordance with the Reports of MM. Bruhns and Hellmann, finally adopted the following resolutions:—

1°. "*The reduction to the sea level by the addition of a constant quantity during the whole year is only admissible for heights not exceeding* 20 *metres, if we wish to obtain an accuracy of* $\pm 0{\cdot}5$ *mm.* ($\pm$ 0·002 *in.*)

"*Consequently for stations situated at a height exceeding metres, account must be taken of the temperature and approximately of the relative humidity, according to Laplace's method.*

2°. "*In weather reports it is desirable that the barometric readings unreduced should be given by the side of the readings reduced to the sea level; in other publications it is necessary to have in all cases unreduced readings.*

3°. "*It is desirable that the International Meteorological Committee should undertake the compilation of fresh uniform tables for the reduction of barometric readings to the level of the sea.*

4°. "*It is equally desirable that the Committee should undertake the preparation of a collection of tables which may be employed in the meteorological systems of the different countries.*"

The four resolutions were submitted to the Congress *en bloc* and adopted.

On the question of observations of "cirrus" clouds proposed by M. HILDEBRANDSSON, the Congress adopted the following resolution:—

"*The observation of the direction of the upper clouds, and especially of cirrus, at some stations in each country, and the publication of these observations in the form of an appendix, is strongly recommended.*"

The next meeting was fixed for Tuesday, 22nd, at 1h. 30m. p.m.

The PRESIDENT announced the Order of the Day:—

1°. Report of Committee IV.

2°. „ „ V.

The meeting closed at noon.

Confirmed at the meeting of the 22nd, G. CANTONI.

Protocol of the Fifth Meeting, 22nd April, at 2h. 10m. p.m.

Delegates present: MM. Aguilar, Auwers, von Bezold, Blaserna, Bruhns, Cantoni, Capello, Denza, Hann, Hoffmeyer, Houzeau, Kokides, Lorenz, Mascart, Mohn, Müller, Neumayer, Paugger, Pittei, Plantamour, Pujazon, Rubenson, Salvatori, Schenzl, Scott, Smith, Snellen, Tacchini, Weyprecht, Wild.

MM. Hellmann, Mendeleef, Weihrauch, Zenger.

Visitors: MM. Cecchi, de Rossi, Grassi, Miraglia, Pisati, Respighi, Sella.

The protocol of the fourth meeting was read and confirmed.

Mr. SCOTT announced the receipt of a letter from M. Bucchich, dated March 12, 1879, respecting question 35, Agricultural Meteorology. This letter had already been considered by Committee No. IV.

The PRESIDENT announced the receipt of the following works:—

Sismografo elletrico a carte affumicate scorrevoli, nota del P. F. Cecchi. Roma, 1876, *con tavola annessa.*

Sismografo elettrico a carte affumicate scorrevoli del P. F. Cecchi direttore dell' Asservatoris Ximeniano, Firenze, 1877.

Sismographi a carte affumicate fisse del P. F. Cecchi. Firenze, 1877.

Il Termometro e il Barometro della Loggia dell' Orgagna in Firenze, del P. F. Cecchi. Firenze, 1871.

Tavola-Meteorografo Cecchi.

Il Microfono nella meteorologia endogena. Studi ed esperienze del professore Michele Stefano De Rossi. Roma, 1878.

The discussion upon the report of Committee No. IV. was opened (Telegraphy, Maritime Meteorology, and Agricultural Meteorology), Appendix IX., p. 75.

M. MÜLLER, secretary of the Committee, read the resolutions upon the different points that they had had to examine.

Question 6: "The Committee recommends the general adoption of the code of figures for Meteorological Telegrams proposed at its fourth meeting at Utrecht.

Question 27: "What progress has meteorological telegraphy made since the First Congress, and how can we contribute to its development?"

Resolution: "*The Congress recommends for meteorological telegrams the general adoption of the code of figures proposed by Permanent Committee at Utrecht, and states that the report which has been presented to the Congress on the actual condition of meteorological telegraphy contains some information with reference to Question* 27."

This resolution was adopted.

Question 28: "What progress has maritime meteorology made since the First Congress?"

Resolution: "*The Congress expresses the opinion that the Maritime Conference in London, in* 1874, *has fulfilled the conditions prescribed by the Congress of Vienna for the study of*

maritime meteorology; it is of opinion, also, that in order to ensure the future progress of this branch of meteorology, the most perfect liberty should be accorded to the institutions interested in making mutually the arrangements which are most suitable for the execution of their investigations."

This resolution was adopted.

Question 29: "What results have the simultaneous observations given, and how may we contribute to their further development?"

M. NEUMAYER stated that the discussion of this question has been twice adjourned, in the hope that General Myer might be able to be present.

Resolution: "*The Congress is of opinion that the development of simultaneous observations contributes greatly to the progress of meteorology, and that all work done in this direction should be encouraged.*"

This resolution was adopted.

Question 34: "In what manner can we best organise and develope the construction and publication of synoptic charts, embracing considerable portions of the surface of the globe?"

A proposition made by MM. HOFFMEYER and NEUMAYER for combined work on a uniform plan on the preparation of Hoffmeyer's Synoptic Charts and the Monthly Review of the Deutsche Seewarte at Hamburg having been submitted to the Committee, and discussed by it, the following resolution was proposed:

Resolution: "*The Congress fully appreciates the importance of the publication which the Meteorological Institutes of Copenhagen and Hamburg propose to undertake, and it hopes for the realization of this project.*"

This resolution was adopted.

Question 35: "How can the development of meteorology in connexion with agriculture and forestry be forwarded by the Congress?"

Resolution: "*In order to contribute to the progress of agricultural and forest meteorology the Congress recommends as a programme for study:*

"1°. *The influence of the meteorological elements upon vegetation.*

"2°. *The inverse influence of vegetation upon the meteorological elements.*

"3°. *Agricultural warnings.*

"*The Congress, finding the subject too important to take a detailed resolution at this meeting, proposes to charge the International Committee with the convening of a special International Conference before next spring, to take into consideration the development of agricultural and forest meteorology.*"

M. BRUHNS wished that, before the meeting of the projected Conference, questions upon the organisation of the agricultural meteorological service in different countries should be addressed by the International Committee to the institutes charged with this service, in order to prepare a report for the Conference.

M. VON BEZOLD was of opinion that a too frequent recurrence of International Conferences would have a tendency to weaken the

authority of Congresses. He would prefer to reserve such questions as that now under consideration for a Congress; nevertheless, he thought that this Congress should not be convened at a date earlier than that indicated by other considerations.

Mr. Scott remarked that the Maritime Conference of London, in 1874, was private, and that it had had considerable success.

The resolution was adopted.

The meeting was adjourned for an hour.

Upon resumption the discussion was opened upon the Report of Committee V. (Distant Stations, &c., Appendix X., p. 79.)

M. Denza, President of the Committee, read the resolutions upon the different questions which it had had to examine.

Question 11: "The Committee draws attention to the importance of establishing distant stations, and supplying them with the necessary instruments."

Question 32: "In what manner should we proceed to establish meteorological stations in distant countries where observations have not hitherto been made?"

Resolution A.: "*The Congress expresses the opinion that the cost of establishment and maintenance of distant stations should not be borne by means of an international fund, but at the expense and under the care of the countries which are in relation with those localities.*"

This resolution was adopted.

Resolution B.: "*The Congress cannot give effect to the proposal of Mr. Parkinson, who has asked for funds for organizing a meteorological service in the Samoa Islands, because it has no international fund at its disposal; but with regard to the importance of this proposal, it expresses the hope that private initiative will permit of meteorological observations being taken in the Samoa Islands.*"

This resolution was adopted.

Resolution C. "*The Congress considering:*

"1°. *That it is of the highest importance that the meteorological stations established by different countries in parts of the globe which are very remote and difficult of access may be visited from time to time in order to ascertain the accuracy of the instruments and of the amount of confidence which can be placed in the observations.*

"2°. *That such an inspection may be most conveniently made by officers of the navies of the maritime Powers.*

"*Proposes to forward to the Governments of the countries represented at the Congress the request that they will kindly take the necessary steps, that, on the one hand, the officers commanding vessels visiting those parts may receive instructions, in pursuance of which they would place themselves in communication with the observers at those meteorological stations, whatever be the nationality of the latter, for the purpose of comparing the instruments, and of acquainting themselves with the manner in which the observations are made; and, on the other hand, that the observer charged with the care of the station may place himself at the disposal of the officer*

visiting it, whatever be the maritime Power by which he is commissioned."

This resolution was adopted.

Resolution D.: "*The Congress recognizes that the establishment of meteorological stations in Bulgaria, Roumania, and Servia would be of the highest importance, and it begs the Italian Government to cause this wish to be communicated to the Governments of those States.*"

This resolution was adopted.

Question 26: "Have since the last Congress, hourly meteorological observations been made at new, and especially continental, stations within the tropics?"

Resolution A.: "*The Congress expresses the desire that the hourly observations made at the existing tropical stations may be continued, and that other analogous observatories may be established, especially in the interior of the continents of the Torrid Zone.*"

This resolution was adopted.

Resolution B.: "*The Congress, recognizing the great importance that meteorological stations in Brazil would possess for the progress of science, begs the Italian Government to make this desire known to the Government of that country.*"

This resolution was adopted.

Resolution C.: "*The Congress decides upon conveying to the Royal Society of London their expression of the importance it attaches to the continuation of the publication of the observations made at Trevandrum by M. J. Allan Broun, and upon requesting that Society to be good enough to take steps to this effect.*"

This resolution was adopted.

Question 30: "What observations do we possess from high mountains, and from balloon ascents, and what measures should be taken to organize these observations more completely?"

Resolution A.: "*The Congress, recognizing the importance that observations made in balloons, especially at places situated in the interior of the continents, may have for the physical study of the higher regions of the atmosphere, recommends the taking of observations of temperature and humidity by means of captive balloons and according to Glaisher's method, in strata at different heights, and on different days and in different seasons. It recommends also the study, by means of captive balloons, of the diurnal range of temperature and humidity in the upper strata of the atmosphere, and the detailed publication of these observations.*"

This resolution was adopted.

Resolution B. (a.): "*The Congress thinks that it would be very useful if observatories could possibly be established on the summits of mountains, and the observations published in extenso, so that they may be placed at the disposal of all meteorologists, and may aid in the solution of problems which may present themselves in future.*

(b.): "*The Congress insists upon the utility of a series of hourly observations of temperature, pressure, direction and force of wind, and eventually also of humidity, on Mount Washington, and especially at Pike's Peak, the highest station upon the earth. This*

series should embrace one year at least; and it would also be desirable to publish in detail the observations already existing for these two stations. General Myer is requested to be good enough to realize these desires of all meteorologists.

(c.) : " *The Congress recommends the Swiss Society of Natural Sciences to do its utmost to promote the establishment of an observatory upon one of the high summits of Switzerland. It expresses the desire that meteorological stations may be established under similar conditions in Italy and other countries.*

(d.) : " *The Congress considers the establishment of the observatory of Etna, proposed by M. Tacchini, of that of Mont Cimone, proposed by M. Parenti, and that of Mont Ventoux, supported by the Meteorological Commission of the Department of Vaucluse, as enterprises of high scientific importance.*"

MM. Tacchini, Mascart, and Denza requested that this resolution might be brought to the knowledge of the different commissions who are charged with the arrangements relating to the establishment of these observatories.

This resolution was adopted.

Resolution C.: " *The Congress requests the directors of the meteorological systems of the various countries to be good enough to publish in a complete manner the existing series of observations made at elevated stations, and which have either not yet been published, or only in an incomplete manner; and at the same time to indicate and describe the stations of their systems which might furnish materials for the study of the upper regions of the atmosphere.*"

This resolution was adopted.

On the proposal of M. Hann, the Congress adopted the following resolution :—

" *The Congress draws the attention of meteorologists to the importance of measuring the variations in length and thickness of the glaciers in the different countries, in order to be able to deduce the relations which exist between these variations and those of the meteorological elements.*

" *As a means of extending our knowledge upon this question the Congress recommends :—*

(a.) : " *To form a complete critical collection of observations made in times past upon the variations of volume of the glaciers.*

(b.) : " *To institute in future continued observations at localities suitably chosen, upon the annual variations of the glaciers in length and thickness, and to publish the results.*

" *The Congress hopes to be able to rely upon the co-operation of the Alpine Clubs and other analogous societies in carrying out these researches.*"

Question 31 : " The Committee, after having taken cognizance of the scheme of M. Weyprecht to establish several observatories in the Arctic and Antarctic regions, so as to organize hourly meteorological and magnetical observations to be made simultaneously all around the Pole, is of opinion that these observations will be of the highest importance in developing meteorology and in extending our knowledge of terrestrial magnetism; it thinks,

therefore, that in the interest of science, it should recommend general participation in this enterprise In what manner can the Congress on its part contribute to the success of the enterprise ? "

Resolution : " *The Congress recognises the great importance which should be attributed to synchronous meteorological and magnetical observations made in the polar regions, by means of simultaneous expeditions, and it recommends all Governments to give the most effective support to such undertakings.*

" *Considering :*

" 1°. *That the majority of the members of the Congress are not provided with instructions relating to this question ;*

" 2°. *That such instructions are absolutely necessary in order to arrive at definite resolutions;*

" *The Congress decides to intrust the International Committee with the convening of a special Conference which should be composed of delegates provided with the necessary instructions and powers by their Governments, who may think they could participate in some way in the enterprise. By reason of the preparations already made by M. Weyprecht and Count Wilczek for an expedition of this nature, it thinks it necessary that this Conference should meet at Hamburg, on the* 1st *October* 1879, *in order to settle the details of the scheme and the means of carrying it out.*"

M. Mascart thought that the date (before Christmas 1879) proposed for the Conference was rather too early.

M. Weyprecht replied that unfortunately he and Count Wilczek could not agree to a later date, if the Congress could not give them the hope of co-operation.

The resolution was adopted.

Mr. Scott announced that there only remained for discussion the 14th proposal of the Programme, viz. :

" The Committee propose to organise, in connexion with the Congress at Rome, an exhibition as complete as possible of the instruments of observation used in the different countries, and they request meteorologists to contribute thereto by sending either instruments or designs to Rome, *Bureau Central Météorologique, Ministère d'Agriculture.*"

Mr. Scott remarked that Captain Hoffmeyer ought to congratulate himself upon the result that his proposal for an exhibition of instruments, made to the Permanent Committee in 1876, had had, and in the name of the Meteorological Council of the United Kingdom, he presented to the Meteorological Office of Italy the collection of British instruments which were in the Exhibition. He expressed the hope that the Central Institutions would exchange specimens of their instruments.

M. Wild presented the photographs of his self-registering instruments to the Meteorological Office of Italy.

M. Blaserna supported the idea of a complete collection of instruments at the principal offices.

Finally, on the proposal of Mr. Scott, the Congress adopted the following resolution :—

" *The Congress expresses the opinion that it is desirable that the*

central institutions should possess specimens of the principal instruments actually in use in other countries."

Mr. Scott announced that the International Meteorological Committee had that day held its first meeting.

M. Wild had been elected President, and Mr. Scott Secretary.

All communications were to be addressed to the Secretary at 116, Victoria Street, London.

Captain Hoffmeyer requested the Committee to make known to meteorologists interested the time of its meetings.

The Congress entrusted its President and Secretaries with the confirmation of protocol of the present meeting. It entrusted the International Committee with the editing of the report of the Congress in the three languages, English, French, and German.

M. von Bezold proposed that there should be an Italian edition.

M. Blaserna did not think that necessary.

The Congress directed the Committee to deposit at the Meteorological Office of the Ministry of Agriculture, &c. at Rome, the original protocols, with a complete set of all reports, &c.

Mr. Smith, in the name of the foreign delegates, requested permission to express to the Italian delegates the most sincere thanks for the kind and cordial welcome which they had received, and for the magnificent manner in which the Congress had been treated by the Italian Government.

M. Cantoni assured the Congress that his fellow-countrymen were truly sensible of the honour which the Congress has done Italy by its visit.

M. Bruhns proposed a vote of thanks to the President, the two Vice-Presidents, and the two Secretaries.

Mr. Scott replied.

The President declared the Meteorological Congress of Rome closed.

The meeting rose at 5h. 30m. p.m.

Approved.

G. Cantoni.

Subsequent to the close of the Congress the following documents were received :—

April 25. A letter from Madlle. Dove, of April 22, expressing the deep sense of gratitude of the family of her late father for the resolution adopted by the Congress at its first meeting (p. 4.)

April 25. A telegraphic despatch from General Myer, from Turin, announcing his arrival in Italy.

April 26. A printed note by M. Brault (who had been unwell during the last days of the Congress) on the construction of synoptic charts.

APPENDIX I.

List of Delegates.

Austro-Hungary	J. Hann	Director of the I. R. Central Meteorological Institution, Vienna.
(For Austria)	J. R. Lorenz von Liburnau.	Councillor at the Ministry of Agriculture, Vienna.
	F. Pangger	Director of the Academy of Commerce and Navigation.
	C. Weyprecht	Lieutenant Imperial Navy.
	R. Müller	Director of the I. R. Hydrographic Institute, Pola.
(For Hungary)	G. Schenzl	Director of the Observatory at Buda-Pesth.
Bavaria	W. von Bezold	Professor at the Polytechnic School and Director of the Central Meteorological Observatory, Munich.
Belgium	J. C. Houzeau	Director of the Royal Observatory, Brussels.
Denmark	N. Hoffmeyer	Director of the Royal Meteorological Institute, Copenhagen.
France	Hervé-Mangon	President of the Council of the Central Meteorological Office.
	E. Mascart	Director of the Central Meteorological Office.
	A. Brault	Director of the Nautical Meteorological Office of France.
Germany	G. Neumayer	Director of the Deutsche Seewarte, Hamburg.
	C. Bruhns	Director of the Royal Observatory, Leipzig.
	A. Auwers	Perpetual Secretary of the Royal Academy of Sciences, Berlin.
Great Britain	H. J. S. Smith	Chairman of the Meteorological Council, London.
	R. H. Scott	Secretary to the Meteorological Council, London.
Greece	D. Kokides	Professor of Astronomy at the University of Athens.
Italy:		
Ministry of Public Instruction.	P. Blaserna (President).	Director of the Royal Physical Institute, Rome.
	L. Palmieri	Senator; Director of the Observatory, Vesuvius.
Ministry of Agriculture and Commerce.	F. Denza	Director of the Meteorological Observatory, Moncalieri.
	P. Tacchini	Astronomer at the Royal Observatory, Palermo.
Ministry of Public Works.	A. Baccarini	Inspector of Civil Engineers, Deputy of the Italian Parliament, formerly Minister of Public Works.
	F. Salvatori	Inspector-General of Telegraphs, Rome.
Ministry of Marine.	G. B. Magnaghi	Director of the Hydrographic Office, Genoa.
	C. Pittei	Director of the Nautical Meteorological Office, Florence.
	G. Cantoni	Senator, Director of the Central Meteorological Office.
Netherlands	H. Snellen	Director of the Royal Meteorological Institute, Utrecht.
Norway	H. Mohn	Director of the Royal Meteorological Institute of Norway, Christiania.
Portugal	J. C. de Brito-Capello	Director of the Observatory of the Infante D. Luiz, Polytechnic School, Lisbon.
Russia	H. Wild	Director of the Imperial Central Physical Observatory, St. Petersburg.
Spain	A. Aguilar	Director of the Royal Observatory, Madrid.
	C. Pujazon	Director of the Observatory, San Fernando.
Sweden	R. Rubenson	Director of the Royal Meteorological Institute of Sweden, Stockholm.
Switzerland	E. Plantamour	Director of the Observatory, Geneva.
United States	A. Myer	Brigadier-General, Chief Signal Officer, U. S. A.

Dr. G. Hellmann	Delegate-Adjunct for Prussia.
Prof. Mendeleef	Delegate of the University, St. Petersburg.
Prof. C. Weihrauch	Delegate of the University of Dorpat.
Prof. K. W. Zenger	Delegate of the Polytechnic School, Prague.

APPENDIX II.

Byelaws for the Second International Meteorological Congress, 1879, proposed by the Permanent Committee.

Sec. 1.

The Congress consists of the delegates appointed by the Governments.

If one of the Members of the Congress makes such a proposal and the meeting adopts it, Visitors may be allowed to be present at the sittings, but they can only take part in the discussions without the right of voting.

Sec. 2.

The Opening of the Congress and the Election of the Bureau.

The President of the Permanent Committee appointed at the Congress of Vienna, or if the President is prevented, one of its Members who is present, and is selected by the Permanent Committee, shall open the first meeting of the Congress, shall submit the Byelaws for approval, and shall propose the election of a Bureau, consisting of a President, two Vice-Presidents, and two Secretaries. These elections shall be made by the absolute majority of the Members of the Congress, delegated by the Governments, who are present at the meeting.

Sec. 3.

The Functions of the President.

The President shall fix the day and hour of the General Meetings. With the concurrence of the Bureau, he shall determine the *agenda* for each meeting. The order of the day should be announced by the President at the commencement of each meeting. The President shall direct the debates and provide for the maintenance of order at the General Meetings. The President shall propose to the Congress the names of the Members of the Committees to which is referred the preparation of the different subjects of the Programme. (Sec. 6.)

Sec. 4.

The Programme of the Deliberations.

The Programme prepared by the Permanent Committee, in accordance with the instructions of the Congress of Vienna, shall serve as a basis for the deliberations. Each Member of the Congress is free to make proposals. With reference to new subjects which are to be brought under discussion, such proposals are to be referred to a Committee, which is to report at one of the subsequent meetings. (Sec. 6.)

Sec. 5.

The Report of the Permanent Committee.

The President will request the Permanent Committee appointed by the Congress of Vienna to present a Report on its action, and to submit to the Congress all the manuscript and printed communications which it has received. As soon as this is done, the functions of the Permanent Committee cease, and its powers are replaced in the hands of the Congress.

Sec. 6.

The Sub-Committees and their Formation.

The various questions of the Programme will be referred to special Committees. The Members of the different Committees are appointed by the Congress on the proposal of the President.

Each Member of the Congress (Sec. 7) is entitled to attend any of the Committee meetings, but without the power of Voting.

Sec. 7.

The Constitution of the Committees.

At the close of each General Meeting the Committees which have been nominated at the Meeting shall constitute themselves by proceeding to the election of a President, a Reporter, and a Secretary.

The President of each Committee shall immediately fix the hour and place of the next Meeting of the Committee.

Sec. 8.

The Method of Voting.

In divisions at the General Meetings the absolute majority of the delegates present shall decide. In the case of equality, the vote of the President shall decide.

If, however, any delegate demands it, a division may take place according to countries. The countries which have less than 10 millions of inhabitants shall have *one* vote; the countries which have from 10 to 30 millions of inhabitants shall have *two* votes; the countries which have more than 30 millions of inhabitants shall have *three* votes. The delegates of each country must come to an understanding among themselves to decide which of them shall be charged with giving the vote of their country.

Sec. 9.

The Protocols of the General Meetings and the Report of the Proceedings of the Congress.

The Protocols of every General Meeting should be read and confirmed either at the end of the Meeting or at the commencement of the next.

The publication of the Report of the Proceedings, as well as the printing, and distribution of the Protocols, should be entrusted to the Permanent Committee (Sec. 10), or to a Special Committee.

Sec. 10.

The Election of the Permanent Committee.

For the interval between the present Congress and the next, the Congress shall choose by ballot the Members of a Permanent Committee, which shall constitute itself by the election of a President and a Secretary.

APPENDIX III.

Programme.

The Permanent Committee, charged by the First International Congress of Vienna with the adoption of preliminary measures for the convening of a second meeting of the same nature, in carrying out the commission entrusted to them, hope that the new Congress, starting from the results which have been already obtained by the first, will not only carry on further the uniformity which is so important for Meteorology, but also will contribute materially to the development of Meteorology in other directions by promoting mutual investigations on a large scale. In order that, on its part, nothing should be omitted which could contribute to the attainment of this end, the Committee has deemed it specially important to prepare carefully the materials for discussion for the future Congress in the following way,—by proposing, once for all, a detailed Programme of proceedings, and by requesting certain special persons to prepare Reports on complicated questions and submit them to the Congress.

The following is the programme of questions to be discussed, which the Committee, after consultation with the delegates to the First Congress, has definitely adopted :

1. Regulations for the Second International Congress of Meteorologists.
Scheme to be drawn up by M. Bruhns.

2. Report of the Committee on their action during the interval between the First and Second Congress.
To be drawn up by Mr. R. H. Scott, the Secretary to the Committee.

3. Report on the conformity with each other, and with the decisions of the Congress of Vienna, of instruments, methods of observation, and publication of observations in the different countries.

4. M. Buys Ballot is requested to prepare a report on the methods employed in the different countries for obtaining true Daily Means from the various combinations of hours of observation.

Proposals made by the Committee.

5. The Committee proposes the general adoption of the forms of publication already introduced in several countries for observations at a certain number of stations of the second order, chosen in each country as International Stations. (See the Reports of the Committee for 1873 and 1874, p. 9, Third Meeting at Utrecht, and Appendix F.)

6. The Committee recommends the general adoption of the code of figures for Meteorological Telegrams proposed at its fourth meeting at Utrecht. (See the above Reports, pp. 12 and 14.)

7. The Committee is of opinion that it is impossible at present to compile general Instructions adapted in their details to the special peculiarities of all countries and all climates. It proposes, therefore, that the Congress should confine itself, in the case of any one demanding typical Instructions, to designating those of the existing Instructions which are most conformable to the decisions of the Congress.

8. The Committee proposes to establish, by small annual contributions from all countries taking part in the Congress, an International Fund, for the expenses incurred by such joint undertakings as those named in the following sections, and the expenses of postage and printing for the Congress and its Permanent Committee.
M. Bruhns is requested to draw up a special proposal on this subject.

9. The Committee requests the delegates to prepare for the Congress at Rome a catalogue of the Meteorological Observations, both published and unpublished, in their respective countries.

10. The Committee proposes to have a comparison made of the standard barometers and thermometers of all the Meteorological Institutes, by referring them to a certain barometer and thermometer which, for the time being, appear to be the best verified. Inasmuch as the International Office of Weights and Measures of Paris will be in possession of such verified standard instruments, a comparison should be instituted with them, and they should serve as a basis for all corrections. At the same time any questions about accurate height above sea level of standard barometers should be raised.
M. Wild is requested to draw up a detailed proposal on this question.

11. The Committee draws attention to the importance of establishing distant stations and supplying them with the necessary instruments.

12. The Committee is of opinion that the establishment of an International Meteorological Institute is at present not possible, nor even desirable, and proposes to provide for the functions and labours which might devolve upon such an institution in the following manner :—

(*a.*) The International administrative functions, such as the execution of the decisions of the Congress, the convening of future Congresses, the care of joint international investigations and undertakings, the administration of the international fund, &c., will be confided, as is already partly the case, to a *Permanent Committee* elected from time to

time by a Congress and required to give an account of its action to the next Congress.

(*b.*) As regards researches which embrace a considerable portion of the globe for the purpose of deducing general laws in Meteorology, it is desirable that permanent relations for the communication of materials should be established between the different central institutes, and that the publications appearing in each country should be distributed gratuitously to all institutes and to all persons who take part in the investigations. These publications are to be, moreover, rendered generally accessible through the agency of booksellers. These international investigations will be based upon the publication of the observations of each country according to the international form, and besides on the special labours which each country may be willing to undertake with regard to its own climate. In the case of supplementary information being required for any countries, it is desirable that a suitable system of reciprocal communications should be devised.

13. The Committee considers the following subjects as possessing a general interest :—

(*a.*) The critical collection and discussion of all existing data on the Diurnal and Annual Range of Air Temperature, and attempts to deduce general laws therefrom.

(*b.*) The critical collection and discussion of all existing data on the Diurnal and Annual Range of absolute and relative Atmospheric Humidity, and attempts to deduce general laws therefrom.

(c.) The critical collection and discussion of all data on the Diurnal and Annual Range of the Amount of Cloud.

(*d.*) Wind tables for the 12 months and for the year.

(*e.*) Tables of Precipitation „ „

(*f.*) New tables of Atmospheric Pressure, with isobars, for the 12 months and for the year.

(*g.*) Charts of the Movements of Storms.

(*h.*) Daily Synoptic Charts, embracing considerable portions of the globe. (See Art. 34).

14. The Committee proposes to organise, in connexion with the Congress at Rome, an exhibition, as complete as possible, of the instruments of observation used in the different countries, and it requests Meteorologists to contribute thereto by sending either instruments or designs to Rome (*Bureau Central Météorologique, Ministère d'Agriculture*).

15. The Committee recommends the establishment of rules and formulæ for reducing barometric readings to the sea level in a uniform manner.

M. Bruhns is requested to draw up a report upon the subject.

16. The Committee proposes the establishment of uniform rules for determining the fixed points of thermometers.

Messrs. Pernet and Balfour Stewart are requested to draw up reports and proposals upon this matter.

Questions.

17. Can definitive rules now be established for the most suitable Exposure of Thermometers destined to give the Temperature of the air?

MM. Buchan and Köppen are requested to draw up reports on this subject.

18. Have additional comparative experiments been made since the first Congress for forming an opinion of the different methods for determining Earth Temperature, which give more definite information as to their relative value?

MM. Ebermayer and Everett are requested to draw up reports on this subject.

19. Have decisive experiments been made since the First Congress to find a simple and appropriate method for determining Radiation, and what is the relation between this and the amount of Aqueous Vapour in the atmosphere?

M. Violle is requested to draw up a report on this subject.

20. What progress has been made in methods for determining the Humidity of the air?

MM. Alluard and Cantoni are requested to draw up reports.

21. What progress has been made in the methods of determining Evaporation?

Messrs. Cantoni and Ebermayer are requested to draw up reports on this subject.

22. Is there any reason to change, after further experience, the decisions of the First Congress respecting the instruments and methods for measuring the quantity of Rain or Snow?

M. Mohn has published a report.

23. How may absolute values of the Velocity of the Wind be deduced from the direct indications of different anemometers?

M. Hoffmeyer is requested to draw up a report.

24. Have, since the last Congress, better methods been discovered for measuring the Ozone in the atmosphere?

25. What progress have the methods for determining Atmospheric Electricity made, and what results have observations of this kind furnished hitherto?

Mr. Everett has already published a report, and MM. Cantoni, Mascart, and Sohncke are requested to draw up reports upon this question.

26. Have, since the last Congress, Hourly Meteorological Observations been made at new, and especially Continental, stations within the Tropics? (See Report of the IVth Commission, Protocol of the Sixth Meeting of the Congress of Vienna, and its First Supplement.)

Mr. Blanford is requested to draw up a report.

27. What progress has Meteorological Telegraphy made since the first Congress, and how can we contribute to its development?

Mr. Scott has published a report, and M. Neumayer is requested to draw up a report thereon.

28. What progress has Maritime Meteorology made since the first Congress?

Mr. Scott has published a report, and M. Neumayer is requested to draw up a report thereon.

29. What results have the Simultaneous Observations given, and how may we contribute to their further development?

M. Buys Ballot and General Myer are requested to draw up reports.

30. What observations do we possess from high mountains and from balloon ascents, and what measures should be taken to organise these observations more completely?

M. Hann is requested to draw up a report thereon.

31. The Committee, after having taken cognizance of the project of M. Weyprecht to establish several observatories in the Arctic and Antarctic regions, so as to organise hourly Meteorological and Magnetical Observations to be made simultaneously all around the Pole, is of opinion that those observations will be of the highest importance in developing Meteorology, and in extending our knowledge of Terrestrial Magnetism. It thinks, therefore, that, in the interest of science, they should recommend general participation in this enterprise. In what manner can the Congress, on its part, contribute to the success of the enterprise?

M. Mohn has submitted his proposals. M. Buys Ballot has promised a report; and M. Neumayer is requested to submit any he may wish to make.

32. In what manner should we proceed to establish Meteorological Stations in distant countries where observations have not hitherto been made?

M. Mohn has published his views, and Mr. Parkinson has made a proposal (regarding the South Pacific).

33. Should we not recommend the general adoption of a certain First Meridian, for example, that of Greenwich, for Synoptic Charts?

M. Bruhns is requested to draw up a report.

34. In what manner can we best organise and develop the construction and publication of Synoptic Charts embracing considerable portions of the globe?
M. Hoffmeyer is requested to draw up a report on this question.

35. How can the development of Meteorology in connexion with Agriculture and Forestry be forwarded by the Congress?

N.B.—The Committee think that, in order to avoid misunderstanding, they should expressly state that the request to certain persons to draw up reports on any questions does not exclude other persons from making such reports on the same questions, but that their object is solely to secure *at least one* report in all cases upon the questions indicated. On the other hand, it seems very desirable that other Meteorologists should treat the subjects in question, in order that the Congress may possibly see them treated from different points of view. With this object the Committee has named several gentlemen as reporters on the different questions. All persons who may be willing to undertake such reports are requested to address them to the Secretary of the Committee (Mr. R. H. Scott, Secretary of the Meteorological Office, 116, Victoria Street, London, S.W.), before the end of January 1879, and, if possible, themselves to have them published in several languages, so that on the one hand the Committee should be better able to prepare the materials for discussion for the Congress, and on the other hand that the reports may be brought to general knowledge and consideration before the opening of the Congress.

Buys Ballot, President, Utrecht,
Utrecht, October 18th, 1878. R. H. Scott, Secretary, London,
For the Permanent Committee of the First Meteorological Congress at Vienna.

APPENDIX IV.

Report of the Permanent Committee.

Introductory. Immediately on its appointment in 1873, and before the members of the Permanent Committee had left Vienna, a preliminary meeting was held to constitute the organisation of the Committee, and to determine upon a course of action. Three meetings have since been held; one in Utrecht in September 1874; one in London in April 1876; and one again in Utrecht in October 1878. The reports of each of these several meetings have appeared in French, German, and English, and are in the hands of the present Congress.

References to the Committee. The subjects specially referred to the Permanent Committee by resolutions of the Vienna Congress were seven in number, and appear in the following order in the report of that meeting.

Resolution 21.—The International Telegraphic Code.
,, 22.—Maritime Meteorology.
,, 24.—General Instructions for all Stations.
,, 25.—The preparation of Normal Standard Instruments.
,, 26.—The Scheme of publication for Stations of the Second Order.
,, 28.—The constitution of the Permanent Committee itself.
,, 29.—The Proposal for an International Meteorological Institute.

In addition four proposals were referred to the Permanent Committee by the Congress.

1. Professor Buys Ballot for the establishment of an International Fund.
2. Dr. Jelinek, for the collection of information on existing Meteorological Systems.
3. Dr. Jelinek, for the collection of information on existing records of observations.
4. General Myer for the organisation of simultaneous observations.

It will be convenient to consider Resolution 28 first, as it refers to the action of the Committee itself.

The resolution runs as follows:

"To express to the different Governments the wish that a new international Congress should be convoked in three years' time.

"In the meantime to determine on the appointment of a Permanent Committee.

"The Committee should consist of seven members chosen by the present Congress, and it has the power to fill up the places of members who resign, and eventually to increase itself by the co-option of two members at most.

"The President shall also be chosen by the present Congress.

"The Committee will have the duty of taking care of the carrying out of the decisions of the Congress, and of arranging for the convening of a future Congress; and it shall, by continual communications, place the delegates of the present Congress in cognizance of its action and proceedings."

Constitution of the Committee.

The Committee has exerted the right of co-option, originally conferred upon it, by the nomination of M. E. Mascart, Directeur du Bureau Central Météorologique de France, as representative of France on the Committee. It has not thought it expedient to co-opt another member. It has, however, had to deplore the loss by death of one of its most valued members, Hofrath Dr. Carl Jelinek, in October 1876; but it has esteemed itself fortunate in being able to fill the vacant place by the election of Dr. Julius Hann, the worthy successor of Dr. Jelinek in the important office of Director of the Austrian Meteorological System.

Representative for France.

Death of M. Jelinek.

Election of Dr. Hann.

Appointment of a secretary.

A slight change in the organisation originally contemplated at Vienna was made at the first meeting of the Committee at Utrecht, by the appointment of Mr. Scott as Secretary, to assist the President in the issue of circulars, and in the management of the correspondence connected with the business of the Committee.

The Committee has not thought it necessary to publish annual reports of its action as originally proposed, but, as already explained, has issued Reports corresponding to each of its several meetings.

The other references to the Committee will now be considered *seriatim*.

Resolution 21.

International telegraphic code.

"The existence of a system of Weather Telegraphy in every country is declared to be a necessity.

"The report of the Congress contains detailed suggestions on the principles and practice of Weather Telegraphy, and a special report on the subject has been published.

"The Permanent Committee is commissioned to propose a uniform system of cypher for Weather Telegraphy, and to circulate it amongst the directors of the several Central Institutes."

A scheme was proposed at the meeting in 1874, and approved, as described in the Report of the Permanent Committee for that year. It has since been very generally adopted in Europe, as appears from the Report on the subject of Weather Telegraphy presented to the present Congress.

At the same time the Committee would point out that Dr. Hann and M. Rikatcheff have recently made proposals for slight modifications of this code.

The Report of the Committee appointed at the Leipzig Conference in 1872, on the subject of Weather Telegraphy and Storm Warnings, has been published in full in English and German, and a copy accompanies the present Report.

Resolution 22.

Maritime Meteorology.

"The Congress declares it to be very desirable that each country should, if possible, collect all its meteorological observations at one place, in order to undertake the organisation of the investigations at the same place. The Institute should be established as near as possible to the sea.

"The Congress is of opinion that the institute for Maritime Meteorology named in the first proposition, might best be placed under the general management of the Chief Institute of the country.

"In consideration of the fact that it will not be possible to devote to Maritime Meteorology at the present Congress a comprehensive consideration corresponding to its importance, but, on the other hand, as it seems that a mutual understanding of the individual maritime nations in regard thereto is necessary, the Meteorological Congress declares that the convening of a Maritime Meteorological Conference is desirable.

"The preparation for this Conference is to be entrusted to a Sub-Committee to be named by the Congress."

A conference on the subject was held at the Meteorological Office in London, in August 1874, and was attended by 24 representatives coming from 14 different countries.

The report of the proceedings has been published in English, and a copy accompanies the present report.

The Permanent Committee may point out as an indirect result of the Conference in London, the recent organisation in more than one European country, of special offices for the discussion of Maritime Meteorology as recommended by the Vienna Congress.

Reports on this subject are submitted to the present Congress by M. Neumayer and Mr. Scott.

Resolution 24.

"The Congress recommends the Permanent Committee, if possible by April 1874, to prepare instructions for the institution and discussion of meteorological observations, to distribute them then in separate copies to all members of the Congress, and subsequently, if possible, after paying all possible attention to the remarks which have been received, to proceed, at the latest in June, to edit and publish them definitively." General instructions.

In the programme for the present Congress the opinion of the Permanent Committee is expressed that it is not possible to carry out this resolution.

Resolution 25.

"The Congress recommends all central offices to adopt real standard barometers, *i. e.*, instruments which allow of the determination of atmospheric pressure according to its definition in absolute measure. The Permanent Committee is commissioned to determine the conditions which such an instrument should fulfil. Standard instruments.

"At the same time the comparison by means of good portable barometers should not be rejected, and the Permanent Committee is instructed to investigate the best manner in which the comparison of the standard barometers at the several central offices can be effected.

"The Congress considers it to be the business of each central office to prepare a standard thermometer for itself on scientific principles, and it recommends all central offices to forward all the Kew standard thermometers which they either already possess or will presently procure, to a gentleman to be indicated by the Permanent Committee, who shall be entrusted by it with the careful comparison of all these with each other, and, if possible, also with the Air Thermometer."

Reports from M. Wild on Standard Barometers, and from M. Pernet on Standard Themometers are submitted to the present Congress.

Resolution 26.

"Each director is to choose in his own district a number of stations for international objects, and, for the publication of observations, is to adopt a common form (within the limits laid down by the hours of observations), which form is to be proposed by the Permanent Committee after inquiry from the directors of the central offices." International scheme of publication.

This subject was referred to MM. Jelinek and Wild by the Permanent Committee. The schemes proposed independently by these gentlemen were discussed at the meeting at Utrecht in 1874, and the resulting plan was embodied in the report of that meeting.

In this form it was submitted to the directors of the Central Institutes by circular dated February 19th, 1876.

It has been very generally approved, as is evidenced by its adoption in most European countries. Almost the only objection to it which has been raised has been that contained in the letter of the Scottish Meteorological Society, printed in the report of the Permanent Committee for 1876, to which communication the Committee replied in the body of that report.

The form is now proposed to the Congress for final and definite adoption.

Resolution 29.

"1. The Congress holds the establishment of an International Institution for the advancement of Meteorology as really useful and desirable. The International Institute.

"2. The Congress furnishes the Permanent Committee with instructions to investigate all the questions bearing on the establishment of this institution and to propose a detailed scheme. The committee should publish the result of its inquiry and proposals in the course of the year 1874, and should disseminate them as widely as possible, so that they can be taken into consideration by a future Meteorological Congress."

This subject has received the most careful consideration of the Committee, and the result of its deliberations is contained in article 12 of the draft programme for the present Congress.

Additional Propositions.

Proposal made by Prof. Buys Ballot :—

The International Fund.

"Should we not express the hope that an International Fund should be established, out of which observatories on islands, and at outlying localities, can be organised and maintained?"

This subject forms article 8 of the draft programme, and a report on it has been prepared by Dr. Bruhns.

Proposals made by Dr. C. Jelinek :—

Reports on existing systems and records.

"The Congress should take into consideration whether it would not be well to request the heads of the various systems of meteorological observations to furnish reports of as uniform a character as is possible, on the organisation of their systems of observation, and especially of their central institution (if there be one), and on the condition of meteorological investigations and publications, as well as on desirable developments and improvements. These reports should be collected and printed in a publication to be selected by the Congress.

"The Congress should take into consideration whether it would not be well in the interest of facilitating meteorological investigations to request the heads of the various systems of observations to state how many long-continued series of observations, printed or not, exist in their respective countries. In the case of printed observations the title of the publication (including publisher's name and the price) should be given, and in the case of unprinted ones, the mode in which either extracts or copies can be procured. For the most important meteorological elements the mean values should be given, with indication of the years from which they have deduced.

"The contents of these communications should be published by a special committee to be chosen by the Congress, and in a manner to be determined by that committee."

The two proposals relative to the collection of information on existing systems of observation and on the condition of the published Meteorological records in each country were embodied in separate circulars printed in the report for 1874, and the replies thereto have been printed in the report for 1876. A suggestion of a similar nature to Dr. Jelinek's second proposal forms article 9 of the present programme.

Simultaneous observations.

At the Vienna Congress a proposal was made by Brigadier General Myer to the following effect :—

"That it is desirable that, with a view to their exchange, at least *one* uniform observation of such character as to be suitable for the preparation of synoptic charts be taken and recorded daily and simultaneously at as many stations as practicable throughout the world."

This was really a revival of a suggestion made more than twenty years previously by Professor Buys Ballot in Poggendorff's Annalen. It has, however, been carried into effect, and a large number of stations, more especially in Europe, have furnished observations taken daily at the appointed epoch of time. The history of the development of this system will be found in the reports of the Permanent Committee. It was at first contemplated by that body that the European simultaneous observations should be made accessible to meteorologists by a special publication, but the extreme liberality of the Government of the United States, in distributing the printed records of these observations gratuitously, has rendered the preparation of a special European publication unnecessary. A report on the subject of simultaneous observations has been prepared by M. Buys Ballot.

Capt. Hoffmeyer's Atlas.

At the same time the Committee has to report to the Congress that it has from the first strenuously supported the undertaking of Captain Hoffmeyer

to publish, by means of special subscriptions, Synoptic Charts for Europe and the North Atlantic. These charts have been issued for a period of 27 months from September 1873 to November 1875 inclusive, and the Committee understand that their preparation for a period of 12 months further is secured.

It seems unnecessary to enter into particulars as to the proceedings of the Permanent Committee, as these are fully detailed in its three reports which are in the hands of the Congress.

The Committee has prepared Bylaws and a Programme for submission to the present Congress, and it will be convenient to conclude the present report with a notice of the different reports which have been proposed for the Congress. These reports have reference to the following questions: Nos. 3, 4, 8, 10, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35.

3. No person was named for the report on the degree to which the resolutions of the Vienna Congress have been carried out, and no report has been received.
4. M. Buys Ballot has prepared a report "Sur la réduction des moyennes "des observations en vraies moyennes."
8. MM. Bruhns and Wild have prepared Reports on the International Fund.
10. M. Wild has prepared a report on the Comparison of Standard Instruments.
15. M. Bruhns has prepared a Report on the Reduction of Barometrical Readings to Sea Level.
16. M. Pernet has prepared a report on the determination of the fixed points on thermometer scales. M. Balfour Stewart has declined, considering that it is premature to make any positive statements on the subject.
17. Neither Mr. Buchan nor M. Köppen have as yet prepared reports on Thermometer Exposure, but the Committee has received reports on this question from MM. Cantoni, Capello, and Wild.
18. MM. Ebermayer, Cantoni, and Wild have prepared reports on Earth Temperature. M. Everett regrets to be unable to find time to write a report on the subject.
19. M. Violle has prepared a report on Solar Radiation.
20. M. Cantoni has prepared a report on Hygrometrical Observations. M. Alluard has not furnished one.
21. MM. Cantoni and Ebermayer have prepared reports on Evaporation.
22. M. Mohn has prepared a report on the Measurement of Rain.
23. M. Hoffmeyer has declined to prepare a report on Anemometry, but MM. Capello and Wild have prepared reports thereon.
24. MM. Everett, Denza, and Palmieri have prepared reports on Atmospheric Electricity. None has as yet been received from M. Cantoni, and M. Sohncke has declined to prepare a report.
26. M. Blanford has prepared a report on the Meteorological Stations in Low Latitudes.
27. Mr. Scott has prepared a report on Meteorological Telegraphy; none has as yet been received from M. Neumayer. MM. Hann, Pittei, and Rikatcheff have made certain proposals on the subject to the Congress.
28. Mr. Scott has prepared a report on Maritime Meteorology, and M. Neumayer has prepared one specially referring to the history and state of Maritime Meteorology in Germany. MM. Pittei and Rikatcheff have made some proposals on the subject.
29. M. Buys Ballot has prepared a report on Simultaneous Observations, none has as yet been received from General Myer.
30. M. Hann has prepared a report on the Observations from Mountain Stations and Balloon Ascents.

    The latter subject has been brought under the notice of Aeronautical Societies in accordance with instructions from the Permanent Committee.

    The subject of the increase or decrease of glaciers, which stands in close connexion with Mountain Observations, has been discussed, at the suggestion of Dr. Hann. It has been submitted to the several Alpine Clubs, and replies from the respective secretaries are presented herewith.

31. MM. Mohn and Buys Ballot have prepared reports on M. Weyprecht's plan for the establishment of Arctic and Antarctic Stations.

Dr. Neumayer has contributed a Memorandum on the Scientific Exploration of the Antarctic Regions.

32. M. Mohn has prepared a report on the possibility of establishing stations in distant localities, and M. Parkinson has submitted, through M. Wild, a proposal for a Meteorological Organisation for the Pacific, with Upolu in the Samoan group as a centre.

33. M. Bruhns has prepared a report on the choice of a First Meridian.

34. M. Hoffmeyer has prepared a report on the construction of Synoptic Charts.

Dr. Neumayer gives an account of an arrangement between himself and Capt. Hoffmeyer on a plan for issuing the Synoptic Charts in future.

35. MM. Bruhns, Denza, and Lorenz have prepared reports on the development of Meteorology in connexion with Agriculture and Forestry.

In connexion with this subject the Permanent Committee would direct the special notice of the Congress to the resolutions of the International Statistical Congress of Buda-Pesth 1876, contained in the Report of the Permanent Committee for 1878.

Proposition of the Fourth Section of the International Statistical Congress at Buda-Pesth in 1876, relative to Agricultural Meteorology.

1. The Congress recommends to the Governments of all countries to institute special observations relative to Agricultural Meteorology, to be afterwards centralized, discussed, and regularly published by the Governments or scientific establishments.

2. The Congress requests the Governments to cause their agents (crop reporters) to send to them monthly reports on the state of vegetation of cereals in their districts.

3. The Congress recommends the Governments to institute observations with the object of ascertaining the influence on climate of the destruction of forests and of planting trees.

4. The Congress expresses the wish that observations relating to thunderstorms, hail as well as periodical phenomena respecting the flora and fauna, may be taken at the greatest possible number of points in each country, and that the results of these observations be centralized, co-ordinated, and published.

5. The Congress expresses the wish that a certain number of meteorological observatories should establish international telegraphic communications between themselves in order to transmit to each other observations, with the view of the establishment of weather forecasts for the benefit of agriculture and commerce. It requests that these observations may be, as far as possible, immediately brought to the knowledge of the crop-reporters and distributed among the public, especially with the object of preventing the effects of frosts, floods, &c.

6. The Congress charges its permanent Committee with the communication of these proposals to the Meteorological Congress which will be held at Rome in 1877, and in case of an understanding being established between the Permanent Committees of the two Congresses, to submit the definitive wish of the Congress relative to agricultural meteorology to the Governments of the different countries.

Cirrus observations.

The Committee would also mention the proposal of M. Hildebrandsson of Upsala, relating to Cirrus Observations, a subject which appears to it to possess very great importance.

The Committee cannot conclude this Report without expressing its heartfelt grief at the irreparable losses which the science has sustained, since the date of the Vienna Congress, in the successive deaths of Jelinek, Le Verrier, Secchi, and even as the Congress is assembling of W. Heinrich Dove, the founder of the entire superstructure of accurate climatological knowledge.

The Committee, with these words, replaces in the hands of the Congress the powers entrusted to it at Vienna in 1873.

ROBERT H. SCOTT,
Secretary to the Permanent Committee.

Rome, April 10th, 1879.

APPENDIX V.

Extracts from Appendix No. VIII. to Report of Treasury Committee on Meteorology, 1877.*

Information obtained from Replies to Questions contained in Circular addressed to Meteorological Departments in Foreign Countries.†

Question 1.—*How many stations are there in your system?*
(*a*) *How many of the* 1*st order?*
(*b*) „ „ 2*nd* „
(*c*) „ „ 3*rd* „

Austria.—259, (*a*) 5, (*b*) 120, (*c*) 78. Stations only recording quantity of rain, 56.

Hungary.—98, (*a*) 2 including the Central Office, (*b*) 84 (bar., pschr., rain-gauge, &c.), (*c*) 12, (thermom. and rain-gauge).

Baden.—16, (*a*) 0, (*b*) 12, (*c*) 4.

Bavaria.—8 official and several private stations.
(*a*) 1 at Munich Observatory.
(*b*) 7, (*c*) none.

Belgium.—No reply.

Denmark.—177, (*a*) 1, (*b*) 16, (*c*) 160.

France.—No reply.

Hamburg.—At present, 11, projected, 31. At present (*a*) 6, (*b*) 4, (*c*) 1. Projected (*a*) 9, (*b*) 0, (*c*) 4 and 18.‡

Holland.—10, (*a*) 2, (*b*) 3, (*c*) 5, and 30 of the 4th order.

Italy.—82, (*a*) 8, (*b*) 20, (*c*) 54.

Portugal.—16, (*a*) 0, (*b*) 11, (*c*) 5.

Prussia.—No reply.

Russia.—129 at work, (*a*) 8, (*b*) 101, (*c*) 20, beside the 250 rain and weather stations of the Geographical Society.

Saxony.—28, (*a*) 1, (*b*) 20, (*c*) 7.

Sweden.—29, (*a*) 1 (Upsala independent of Central Institute) (*b*) 28, (*c*) none under Central Institute.

Norway.—50, (*a*) 0, (*b*) 32, (*c*) 18 and 130 for thunderstorms alone.

Switzerland.—68. The number, however, varies somewhat from year to year (averages about 70) (*a*) 3, (Geneva, St. Bernard, Berne) (*b*) 45, variable (*c*) 20, variable.

United States.—102. 88 stations make full telegraphic reports; 11 make full observations and report by mail; 3 are printing stations at which meteorological observations are not made. There are besides, 20 river stations under the direction of the Signal Office.

Total of daily reports filed at the Office of the Chief Signal Officer now numbers as follows:

Daily service simultaneous reports - - - -	109
International daily simultaneous reports - - -	268
Reports of voluntary observers - - - -	393
Reports of medical corps of the Army - - -	102
„ „ „ Navy - - -	5
Grand total of daily reports received regularly for discussion - - - - - - - -	877

(Annual Report for 1865, p. 93.)

Canada.—107 stations at present. Volunteer observers are added from time to time, while others drop off. Such of the drum agents as are also regular

* Report of the Treasury Committee appointed to inquire into the conditions and mode of administration of the annual grant in aid of Meteorological Observations. Presented to both Houses of Parliament by command of Her Majesty.

† The information has reference to the year 1876. The statistics as regards England are contained in the body of the Report, and therefore do not find a place in an Appendix to that Report. As regards the United States, no reply to the circular was received from Washington, and the answers to the several questions have been compiled from the published Reports of the Chief Signal Office.

‡ These last 18 will only record wind regularly and barometrical alterations during storms.

observers are included in the number 107; but there are also 13 drum agents whose reports relate only to storms and storm warnings. (*a*) The Toronto observatory is *in strictness* the only station of the first order, but there are 10 stations which may be regarded as *partially* of the first order. They hold a rank higher than those of the second order, as observations of some of the elements are taken night and day at equal intervals of *three* hours or at equal intervals of *two* hours. Seven of these stations are furnished with anemographs. (*b*) 38, exclusive of the two stations which are partially of the first order. Two of these have anemographs. (*c*) 58.

	(*a*)	(*b*)	(*c*)	Extra.	Total.
Austria - - -	5	120	78	56	259
Hungary - - -	2	84	12	—	98
Baden - - -	—	12	4	—	16
Bavaria - - -	1	7	—	—	18
Belgium. No reply.					
Denmark - - -	1	16	160	—	177
France. No reply.					
Hamburg { at present -	6	4	1	—	11
Hamburg { projected -	9	—	4	18	31
Holland - - -	2	3	5	30	40
Italy - - -	8	20	54	—	82
Portugal - - -	—	11	5	—	16
Prussia. No reply.					
Russia - - -	8	101	20	—	*129
Saxony - - -	1	20	7	—	28
Sweden - - -	1	28	—	—	29
Norway - - -	—	32	18	130	180
Switzerland - -	3	45	20	—	68
United States - -	88	11	3	20	122
Canada - - -	11	58	58	—	107

Question 2.—*Are these stations at which no self-recording instruments are used, but only eye observations made?*

(*a*) *If so, to what purposes are the latter put?*

Austria.—At the five stations of the first order *registering instruments* are used. Eye observations are verified, sometimes reduced, and always kept for reference at the Central Meteorological Institute. The monthly and yearly results, to be used for climatological investigations, are published for all stations in the *Jahrbuch der Central Anstalt*.

Hungary.—At all stations eye observations are made; self-recording apparatus exists only at the Central Station of Buda-Pesth and at Agram; in Agram and Buda-Pesth barometer, thermometer, Robinson's anemometer. Besides these are self-recording anemometers in Zeugg and Carlstadt (Croatia).

(*a*) Cistern barometer, psychrometer, rain-gauge, and eventually a wind vane.

Baden.—No self-recording instruments.

Bavaria.—At the station of the 1st order some self-recording instruments are to be found.

Belgium.—No reply.

Denmark.—The institute possesses no self-recording instruments.

France.—No reply.

Hamburg.—At six stations, including Hamburg, self-recording anemometers are already placed, in three others these will be erected; a barograph is now acting in Hamburg; of the other stations at least three, possibly even seven, will receive barographs.

Holland.—At four stations there are self-recording instruments. (*a*) The eye observations are published as well as the others.

* In addition to the 250 rain and weather stations of the Geographical Society.

ITALY.—The stations of the first order are provided with registering instruments for the larger part of meteoric phenomena. Those of the second order are also provided with them, but only for some of the phenomena. The others register only the direct or eye observations.

PORTUGAL.—Yes. (*a*) The observations of the continental stations and from Funchal are published in the daily report of the Government Journal, and in other newspapers. The observations of all the stations are published in the "Annaes do Observatorio do Infante D. Luiz." Those of the three international stations are published in schedules as adopted by the Congress of Vienna.

PRUSSIA.—No reply.

RUSSIA.—The stations of the 1st order have partly self-recording instruments; all stations of the 2nd order make only eye observations, which are published *in extenso* in the annals of the Central Observatory.

SAXONY.—Only at stations of the 1st order are self-recorded observations made; at all others only eye observations.

(*a*) For climatology.

SWEDEN.—Yes, with the exception of Upsala.

NORWAY.—Yes.

(*a*) Printed in Jahrbuch.

SWITZERLAND.—Self-recording instruments, the data of which are published, exist only at Bern. At St. Bernard, and at Geneva, direct observations are made from 6 a.m. to 10 p.m. at intervals of two hours.

UNITED STATES.—No self-recording instruments yet used.

CANADA.—No self-recording instruments, excepting anemographs, are in use out of Toronto. 12 stations report to Toronto three times daily by telegraph for purposes of prognostication. These, as well as those of the (partial) first order, and those of the second order, report weekly by mail; while stations of the third order report by mail monthly. (*a*) The reports received by mail, after examination and intercomparison, are arranged in forms suited for the discussion of various scientific questions. The reports are also employed for tracing out the results of former prognostications.

Question 3.—What means are taken to ensure correctness at all the stations?

AUSTRIA.—Correctness is ensured principally by comparing the results of observations made in two or more stations situated in the vicinity of each other.

HUNGARY.—By the distribution of similar verified instruments and the use of the tables of reduction calculated by the Central Office. The instruction is quite analogous to that of the Austrian Organisation.

BADEN.—Yearly tours of inspections.

BAVARIA.—The stations are from time to time inspected and the instruments tested.

BELGIUM.—No reply.

DENMARK.—Annual inspections; frequent testing of instruments by the observers; monthly discussions of the results of the observations with the aid of synoptical charts constructed for pressure, temperature, rain.

FRANCE.—No reply.

HAMBURG.—Regular yearly and also occasional inspections, further control through the daily telegrams and the monthly tables.

HOLLAND.—Continual comparison every month. As soon as a station records an improbable observation I inquire after that. Moreover, I have two different barometers at each place, observed by two different persons.

ITALY.—For the stations of the first and second order the instruments are compared and inspections are made.

PORTUGAL.—Instruments of the same model all compared with the standards of this observatory, where the observers must have one month's practice.

PRUSSIA.—No reply.

RUSSIA.—The instruments are verified at the Central Observatory and the stations inspected from time to time.

Saxony.—The instruments are in the first place all verified individually, and by the comparison of the results of the stations one with another a proof is obtained of the correctness of the observations.

Sweden.—Examination of the journals sent in, and tours of inspection.

Norway.—Inspection. Construction of curves and charts.

Switzerland.—Comparative critical examination of the tables leads to the instant discovery of large and constant errors. Correspondence and inspections.

United States.—Frequent inspection, and also examination of returns at Central Office. (See answer to question 9.)

"The course at the school of instruction and practice at Fort " Whipple is intended to furnish a force of selected enlisted men at " once disciplined as soldiers, and fitted by special instruction for the " different special duties of the Signal-Service. There have been " instructed during the year 80 men as assistant observers, and 42 for " promotion to the grade of serjeant. (Report for 1875, p. 3.)

" Special instructions are given in the use of the system of Weather " Reports adopted by this Office, and in the care and management of " stations.

" The number of *Naval* officers fully instructed during the year has " been 12; of the *Army*, 3. In addition to this, 2 officers were " instructed in Meteorology alone, having previously completed the " other part of the course." (Report for 1871.)

Canada.—Correctness in observations is sought by supplying printed and written directions, by oral instructions through visitors, and by notifying observers by letter whenever errors in their reports are detected.

Question 4.—*How often and at what hours are observations made?*

Austria.—The observations (with exception of the mere rain stations) are taken three times in the day. It was impossible to induce all observers to choose the same hours. Of the above cited number of 203 observers there observed at 7, 2, and 9, 134 or 66 % at 6, 2, and 10, 14 or 7 % at 7, 2, and 10, 14 or 7 %, at other combinations 41 or 20 %.

Hungary.—Three times daily; the combination of hours is various:—

7 a.m.	2 p.m.	9 a.m.
6 „	2 „	10 „
8 „	1 „	8 „

Baden.—Three times a day, at 7, at 2, at 9.

Bavaria.—At stations of the 2nd order twice a day; in winter at 9 am. and 4 p.m., in summer at 7 a.m. and at 6 p.m.

Belgium.—No reply.

Denmark.—Ordinarily three times a day (8 a.m. 2 and 9 p.m.)

France.—No reply.

Hamburg.—8, 2, 4. and 8 o'clock, of which 4 o'clock is only arranged for telegrams and is not included in the annual publications.

Holland.—At every place three times a day at 8 and 2, and besides at 8 or 10 p.m.

Italy.—The stations of the first order observe at 6 and 9 a.m., at noon, at 3, 6, and 9 p.m. Those of the second order observe at 9 a.m., 3 and 9 p.m., and make also simultaneous observations with Washington, like those of the first order. The others observe only at 9 a.m. and at 3 and 9 p.m.

Portugal.—Four stations at 9 a.m., 0 and 3 and 9 p.m. Six stations at 9 a.m., 0, and 3 p.m. One station 9 a.m. and 3 p.m. Five stations only at 9 a m. The International stations (Campo Maior, Angra, Funchal) make further one observation at 7.35. Washington time.

Prussia.—No reply.

Russia.—Three times a day at 7 a.m., 1 and 9 p.m. in stations of the 2nd order.

Saxony.—Daily at stations of the 2nd order, three times at 6, 2, and 10 o'clock.

Sweden.—Three times a day at 8 a.m., 2 p.m. and 9 p.m.

Norway.—Three times; 8 a.m., 2 p.m., and 8 p.m.

Switzerland.—Three times. Observations are made at 7 a.m., 1 and 9 p.m.

UNITED STATES.—The total number of stations from which telegraphic reports of meteoric changes are received *tridaily*, in regular series, is 101. (Report for 1875, p. 88.) The hours of observation are 7 a.m., 2 p.m., and 9 p.m., local time of the stations. (Report for 1874, pp. 88, 89.)

CANADA.— At *telegraph* stations observations are made synchronously at 7.25 a.m., 4.25 p.m., and 10.50 p.m. (Toronto time), and at some of these stations additional observations are made at 7 a.m., 2 p.m., and 9 p.m. *local* time.

At some of the partial stations of 1st order, observations are at every even hour, and some at every third hour, ending in each case with midnight; while at others where the three telegraph hours are used, six additional observations are taken, so as to form eight equidistant times from 1.25 a.m. to 10.25 p.m.

For other stations the hours preferred and most frequently used are 7 a.m., 2 p.m., and 9 p.m.; but sometimes it is necessary to employ 7 a.m., 1 p.m., and 9 p.m. and in a few cases, other combinations.

Question 5.—How are the observations recorded? Who supplies the schedules.?

AUSTRIA.—The observations are recorded in monthly forms or schedules, and these are sent by mail to the Central Institute.

HUNGARY.—The results in the year books. Daily observations only from the two stations, Buda-Pesth and Fiume, in monthly tables. The schedules are supplied by the Central Office.

BADEN.—In our large monthly form (that invented by Dove.) The Central Station at Carlsruhe.

BAVARIA.—In tables drawn up for that purpose.

BELGIUM.—No reply.

DENMARK.—The Institute furnishes lists to the observers, who return them with observations each month.

FRANCE.—No reply.

HAMBURG.—Day-books for the first entry of the observations at the instrument, and monthly tables are furnished by the Observatory, a sample of which is enclosed.

HOLLAND.—The Central Office has given the model of the schedules.

ITALY.—In the schedules distributed by the Ministry of Commerce and Agriculture only the observations of 9 a.m., 3 and 9 p.m., and the simultaneous observations are registered.

PORTUGAL.—One schedule per month for every hour of observation furnished by this Observatory.

PRUSSIA.—No reply.

RUSSIA.—Instructions and schedules for observation supplied gratis to all observers by the Central Observatory.

SAXONY.—On tables, the headings of which are lithographed. The schedules are supplied by the Central Station.

SWEDEN.—In printed forms. The Central Institute.

NORWAY.—In schedules, supplied by the Meteorological Institute.

SWITZERLAND.—The observations are recorded in monthly tables, which are furnished by the Central Institute.

UNITED STATES.—Schedules supplied from Central Office.

CANADA.—The schedules are supplied from the Central Office, Toronto.

Question 5a.—If supplied from the Central Office is their cost defrayed from its own funds?

AUSTRIA.—The cost of printing these forms is defrayed by the Central Institute out of its general fund.

HUNGARY.—Funds for this purpose are not supplied. The schedules are defrayed out of the budget of the Central Office, under the title of "Chancery expenses," covering the cost of printing.

BADEN.—All meteorological expenses are defrayed by the Minister of Commerce.

Bavaria.—The expense is defrayed at the official stations by the Government.
Belgium.—No reply.
Denmark.—The Institute pays for the lists.
France.—No reply.
Hamburg.—Out of the funds of the Marine Observatory.
Holland.—They are supplied partly at the cost of the observers, who have some liberty in the form.
Italy.—The schedules are given gratis by the Ministry of Agriculture and Commerce,
Portugal.—Yes.
Prussia.—No reply.
Russia.—The Central Observatory.
Saxony.—Yes, they are paid out of the funds of the Central Station.
Sweden.—Yes.
Norway.—Yes.
Switzerland.—The cost is defrayed from the credit allowed by the Government.
United States.—Expense paid by the State.
Canada.—Their cost is defrayed by the Central Office.

Question 6.—*Are the observers paid? and if so, at what rate?*

Austria.—The observers are voluntary and not paid. There are some few observers at stations on mountains (persons employed at mining works) who receive a very small allowance of about 3*l.* 12*s.* a year.
Hungary.—No; participation is voluntary; only at certain military hospitals and at the imperial stud farms there are official observers. As remuneration 100*l.* a year is allowed, which is divided between 20 observers.
Baden.—Certain observers are voluntary, but the majority are paid. Those who observe *all the Meteorological Elements and carry out the subsidiary calculations* are paid 18*l.* a piece. Those who only observe 13*l.* 8*s.*
Bavaria.—At the Official Stations each observer receives 12*l.* 10*s.* a year.
Belgium.—No reply.
Denmark.—Observers of the second order are paid at the rate of 7*l.* per annum.
Hamburg.—At various rates: the normal payment is about 15 guineas. The three head agents of the Marine Observatory, who are also otherwise employed, receive 140*l.*
Holland.—The observers are not paid by the Central Office. Only a small present is given to some of them.
Italy.—The greater part of the meteorological observatories being of private foundation, the State incurs no expense for them. It only gives instruments sometimes, by way of encouragement, gratuitously. The stations of the first order and some annexed to the astronomical observatories or to the universities, are completely at the charge of the Ministry of Public Instruction.
Portugal.—Directors, gratis; observers, 2*l.* per month.
Prussia.—No reply.
Russia.—The observers in stations of the first order are paid from 34*l.* to 115*l.* a year. In the ports the observing marine officers receive from 42*l.* to 75*l.* a year. The observers in stations of the second order are, only in exceptional cases, paid from 14*l.* to 21*l.* a year.
Saxony.—Yes; an observer of the second order of station receives 10*l.* 10*s.*; one of the third order 30*s.* to 6*l.*
Sweden.—Yes, 11*l.* 5*s.*
Norway.—19 observers are paid 8*l.* a year.
Switzerland.—Certain (about 10) needy observers are paid; such, when they reduce the observations themselves, receive about 4*l.*; the rest, who only send in original observations, about 2*l.*
United States.—The observers are non-commissioned officers and privates specially enlisted and instructed for the signal service. The remunera-

tion for their meteorological and other services, paid out of the fu appropriated to the army is as follows:

	£
150 sergeants - - -	6,120*
30 corporals - - -	1,080*
270 privates - - -	8,424*

Canada.—Payments to observers to cover allowances to assistants are as follows:—

At two stations, partially of 1st order (Artillery stations) service gratuitous.

At eight stations partially of 1st order, from 60*l.* to 140*l.*

At 12 telegraph stations from 60*l.* to 86*l.*

These include some also paid as belonging to the former class.

At four Reserve Telegraph stations from 24*l.* to 60*l.* Drum agents, not included in former classes, are usually paid 1*l.* per month.

At remaining stations the observers are not paid.

Question 7.—Who appoints the observers?

Austria.—Generally persons disposed to make Meteorological Observations apply to the Central Institute, and it is there decided whether the offer has to be accepted or not, considering the situation of the already existing stations.

Hungary.—As they observe voluntarily no one appoints them.

Baden.—The Director of the central station appoints the observers with special regard to Local experience.

Bavaria.—The head of the central station in connection with the department of Finance.

Belgium.—No reply.

Denmark.—The Institute pays the observers.

France.—No reply.

Hamburg.—The Chief of the Admiralty.

Holland.—At some places the observers are appointed and changed by the higher schools, at others by the Waterstaat, &c.

Italy.—See answer to Question 6.

Portugal.—The Government.

Prussia.—No reply.

Russia.—No reply.

Saxony.—The Superintendent of the Central Station.

Sweden.—The Meteorological Central Institute.

Norway.—The Institute.

Switzerland.—The Meteorological Commission of the Swiss Society for Natural Science. (Naturforscher Gesellschaft.)

United States.—Chief Signal Officer appoints those who are at the stations established and supported by the State.

Canada.—The observers, in nearly every case, are selected by the superintendent, subject to the approval of the Marine Department.

Question 8.—Can they be changed?

Austria.—They change rather too often, because after a certain lapse of time the work of taking three daily observations becomes tiresome to the greater part of the observers. In some, but rare, cases observers are dismissed by the Central Institute if the observations sent in show signs of neglect or falsification of the registers by putting in interpolated instead of observed readings.

Hungary.—They cannot be changed; that is to say, not officially from one station to another.

Baden.—Yes.

Bavaria.—Yes, if necessary.

Belgium.—No reply.

Denmark.—The Director alone is independent.

France.—No reply.

* Calculated at 5 dollars to the £.

HAMBURG.—Yes.
HOLLAND.—At some places the observers are appointed and changed by the higher schools, at others by the Waterstaat, &c.
ITALY.—See answer to Question 6.
PORTUGAL.—Yes.
PRUSSIA.—No reply.
RUSSIA.—All paid observers can be changed at the direction of the central observatory.
SAXONY.—Yes, whenever the observer proves not to be trustworthy.
SWEDEN.—Yes.
NORWAY.—Yes.
SWITZERLAND.—Yes, but if they have observed faithfully for 3 years, then the instruments become their property.
UNITED STATES.—Observers at the State Station can be changed by the Chief Signal Officer.
CANADA.—Observers can be *dismissed*, but it is not always practicable to *change* an observer, on account of the impossibility sometimes of finding another resident suitable for the duty. This trouble will be removed when the proposed staff of disposable observers has been organised.

Question 9.—How often are the stations inspected?

AUSTRIA.—The great drawback of our organisation has been that till the present time inspections could have been carried out very rarely. The reasons for it were insufficiency of the staff at the Central Institute and want of funds destined for the expenses connected with the inspections.
HUNGARY.—Every year a fixed No. of stations, 15–20 are inspected, the instruments compared, and their condition investigated.
BADEN.—Once a year.
BAVARIA.—About every 2 years on an average.
BELGIUM.—No reply.
DENMARK.—The Stations of the 1st and 2nd order annually; the others successively.
FRANCE.—No reply.
HAMBURG.—Every year.
HOLLAND.—As often as it appears to me necessary from the records.
ITALY.—It has been settled that the stations of the two first classes shall be inspected every two years.
PORTUGAL.—They must be inspected once every three years.
PRUSSIA.—No reply.
RUSSIA.—Irregularly; partly according to existing requirements, partly by employing what opportunities offer.
SAXONY.—Every year.
SWEDEN.—At present about every three years and oftener if necessary.
NORWAY.—Some every year, at least every fourth year (in the North of Norway).
SWITZERLAND.—Every two or three years.
UNITED STATES.—The constant and exact work required at the numerous stations now connected with this Office, renders it necessary that each station should be frequently and minutely inspected, the books and papers examined, and the instruments compared with standard instruments. Each station ought to be inspected at least once in each period of six months.

Eighty-one stations have been inspected during the fiscal year; 10 of these, upon the lakes, were inspected twice. Paper 8 shows the date of each inspection, and the names of the stations inspected. (Report for 1875, p. 103.)

CANADA.—While the importance of frequent visitation is fully recognised (*see* Fourth Annual Report of Superintendent of Canadian Meteorological Office), and it is proposed, when practicable, that all stations should be visited *at least* once in each year, the magnitude of the territory concerned, extending from Newfoundland to Vancouver, and northwards beyond the Arctic circle, and the insufficiency of the present staff, have

hitherto made proper visitation impracticable. The more important stations have not been visited, on an average, more than once each year, while many have never yet been visited.

Question 10.—*By what persons and at whose expense?*

Austria.—It is the Superintendent (Director) of the Central Institute who has to decide whether he himself or other persons of the staff have to inspect a given group of stations. The costs are defrayed out of the general funds. ("Dotation" annually granted to the Central Institute.)

Hungary.—Usually by the Director and generally in connexion with magnetic determinations of locality. In Buda-Pesth a yearly sum of 50*l.* for general expenses.

Baden.—By the Director of the Central Station or a Deputy.

Bavaria.—By the Head of the Central Station, or by his assistants at the Expense of the Government.

Belgium.—No reply.

Denmark.—By the Director or by an assistant. The Institute pays for the journeys.

France.—No reply.

Hamburg.—At the expense of the observatory by one of its officers.

Holland.—At the expense of the Central Office by the Director of the observations.

Italy.—At present no certain information can be given on this point.

Portugal.—By the observers of this observatory and from its funds.

Prussia.—No reply.

Russia.—By officials of the Central Institute, occasionally also by scientific travellers, at the expense of the Central Institute or of special Government allowances.

Saxony.—By the Superintendent out of the funds.

Sweden.—One of the officers at the expense of the Central Institute.

Norway.—The Director or the first assistant at the expense of the Institute.

Switzerland.—By members of the Meteorological Commission, or by the head of the Meteorological Office at the cost of the nation.

United States.—Lieutenants Grugan, Greely, and Gibbon have been employed upon this duty; the former throughout the entire year; Greely, until transferred to other duty; Gibbon, until his relief from signal duty. (Report for 1875, p. 103.)

Canada.—The stations are visited by the superintendent or by one of his assistants, and at the cost of the Central Office.

Question 11.—*Who supplies instruments?*

Austria.—With regard to the limited funds granted to the Central Institute, it is endeavoured to have the instruments provided at the cost of the observers. This is especially the case if the observations are to be made at a public school or institution, or by persons known to be in wealthy circumstances. In the greater part of cases, however, if the observers are poor or not willing to buy the instruments themselves, these are lent to the observers by the Central Institute.

Hungary.—The Central Office. Out of the budget a sum of 200*l.* is set aside yearly for this purpose.

Baden.—The Central Station at the expense of the Ministry of Commerce. The voluntary observers have supplied a great many instruments at their own expense.

Bavaria.—On the recommendation of the superintendent of the Central Station through the Department of Finance.

Belgium.—No reply.

Denmark.—Ordinarily the Institute. A considerable number of the stations of the third order have been organised by private persons who have paid for the instruments delivered by the Institute.

France.—No reply.

Hamburg.—The Marine Observatory.

Holland.—If I can obtain the instruments from others, I am very glad; if not, I supply them myself.

ITALY.—See answer to Question
PORTUGAL.—This observatory.
PRUSSIA.—No reply.
RUSSIA.—Partly the Central Institute, partly the Marine, partly societies and private persons.
SAXONY.—The Central Institute.
SWEDEN.—The Central Institute.
NORWAY.—The Institute. A few barometers are supplied by the telegraph director, viz., for reporting stations.
SWITZERLAND.—The Meteorological Commission. They are furnished by Hermann and Pfister, opticians in Berne.
UNITED STATES.—The work in the instrument and model room referred to in former reports has been continued. 521 Meteorological instruments have been compared during the year with the standard instruments in the Office, and 450 have been issued thence after comparison. (Report for 1875, p. 102.)
CANADA.—The instruments are usually supplied *on loan* by the Central Office; but sometimes they have been purchased by observers through the Central Office, and, in a very few cases, through other channels.

Question 11*a*.—*Are they verified before or after erection?*

AUSTRIA.—The instruments are always verified at the Central Institute before sending them to the stations, and they are again verified at the place of the station if an opportunity presents itself.
HUNGARY.—Yes; the barometers (cistern) by 20 comparisons. Thermometers are usually only tested at the zero point.
BADEN.—They are compared with the travelling instruments on the tour of inspection.
BAVARIA.—Verified before erection.
BELGIUM.—No reply.
DENMARK.—The instruments are always regulated with the normal ones of the institute before they are sent out, and the new stations are inspected as soon as possible.
FRANCE.—No reply.
HAMBURG.—Before erection, later by inspection.
HOLLAND.—Thermometers only before; barometers before and after.
ITALY.—They are verified before distribution.
PORTUGAL.—Before.
PRUSSIA.—No reply.
RUSSIA.—Before; but only for the most part the barometers; afterwards during inspections.
SAXONY.—The instruments are verified before erection and after the erection is completed.
SWEDEN.—Before the sending out and at the inspection.
NORWAY.—Both.
SWITZERLAND.—After erection.
UNITED STATES.—See answer to preceding question.
CANADA.—Instruments from the Central Office are *always* tested before erection, and also occasionally afterwards by visitors. Instruments not passed through the Central Office have in most cases been tested by visitors.

Question 12.—*What staff is employed in the Central Office?*

AUSTRIA.—1 director, 3 adjuncts, 1 assistant, 1 account clerk, 2 calculators, 1 telegraphist, 1 photographer, 1 messenger, 1 gardener, charged at the same time with the functions of a *concierge*. The Government has been asked to grant the employment of a 2nd assistant, and of a person skilled in mechanic's work. The 5 first named form the scientific staff. The position of the adjuncts is a higher one compared with that of the assistant, the former being permanently appointed, the latter for 2 years only (and exceptionally for 6 years). The assistants are taken generally out of the candidates for professorships at middle schools and must have prosecuted their studies at an University or a High Technical School.

HUNGARY.—The personal staff consists of 1 director, 2 observers (land meteorology), 1 writer and 1 messenger.

BADEN.—One assistant calculator under the superintendent, but this is only a subordinate post for the former.

BAVARIA.—A central office does not yet exist in Bavaria, but will however soon be instituted. The Central Station is at Aschaffenburg.

BELGIUM.—No reply.

DENMARK.—1 director, 2 assistants, draughtsman and calculators, custodian.

FRANCE.—No reply.

HAMBURG.—Division 1. (*See* the Instructions of the German Marine Observatory).

HOLLAND.—The director of the observations on land. The director of the section for navigation. The observer at Utrecht.

ITALY.—This office is not yet thoroughly organized, and consequently no information can be given in reply to this question, nor to the following ones as far as the 16th. The Meteorological Direction which superintends the publications is dependent on the Ministry of Agriculture and makes use of its employés.

PORTUGAL.—3 observers, 3 adjuncts, 1 artist photographer, 2 servants.

PRUSSIA.—No reply.

RUSSIA.—Director, his assistant, 4 physicists, 4 observers, 4 calculators, secretary, mechanician, office-keeper. Also free engaged calculator and writer.

SAXONY.—A superintendent. An assistant. A book keeper.

SWEDEN.—2 officers (1 director and 1 amanuensis), several calculators (3 at present) who work at home and 1 servant.

NORWAY.—Director and 4 assistants.

SWITZERLAND.—A head of the office and 2 assistants.

UNITED STATES:

Division of Duties.—The officers on duty at this office are classified as 1st, commissioned officers of the army and acting signal officers who have been announced in orders as "assistants to the Chief Signal Officer;" 2nd, other commissioned officers of the army; and, 3rd, civilian assistants.

The duties of the office are divided as follows:

1. One assistant to the Chief Signal Officer has charge of the orders, records, and general correspondence of the office, critically examining all papers presented him for file, and reporting upon any irregularity. He has also the superintendence of enlistments, and performs such other duties as may be specially assigned to him.

2. One assistant to the Chief Signal Officer has charge, as property and disbursing officer, of all matters pertaining to money and property (all communications upon which subject will be referred to him for action) together with such duties as may be specially assigned to him.

3. One assistant to the Chief Signal Officer has, as instructor, charge of all matters pertaining to the instruction of the signal service of the army, and in addition as "assistant in charge of stations," is charged with the general supervision of the observer-sergeants upon stations, and of the receipt, record, and publication of the weather reports at this office, together with such duties as may be specially assigned to him.

4. The preparation of the current "Synopsis and Probabilities" and of the official publications in relation to practical Meteorology, including the "Weekly Weather Chronicle," "Monthly Weather Review," "Daily Bulletin," "Synopsis," "Probabilities," and "Facts," and such other duties as are related thereto, is divided between the several assistants to the Chief Signal Officer and civilian assistants, in accordance with a roster to be published from time to time, providing in advance for the specified period. In the absence of other orders, the assistant, who at any time may be relieved from the preparation of the current Synopsis and Probabilities, takes charge of the preparation of the publications above alluded to.

5. One officer has charge of the instrument room, and the examination, comparison, and repair of the instruments therein, together with such duties as may be specially assigned to him. He submits a written report to the Chief Signal Officer every ten days on the condition of each instrument, whether its record is satisfactory as a standard; if not, to what extent it

has been unreliable in its indications, with, if possible, a statement of the cause, and suggestion of the remedy. His duties are more fully specified under a separate section below.

6. Two commissioned officers of the army and acting signal officers will be detailed as inspectors of stations. Their duties are fully set forth in a separate section below.

7. The assistants to the Chief Signal Officer mentioned in paragraphs 1 and 3 of this section will be permanent members of the board convened at this office for the examination of applicants for enlistment, and for instruction in the duties of assistant to an observer on station, and also of the board convened for the examination of candidates for promotion to the grade of serjeant, signal service. Commissioned officers of the army, other than those last above referred to, will, as occasion requires, be detailed to be additional members of each of these boards.

" The probabilities are announcements of the changes considered from " the study of the charts in connection with such rules and generalizations " as the experience of the Office and the study of meteorologists seem to " have determined as probable to happen within the next 24 hours. The " preparations of these charts, and the reports based on them, have been " under the immediate charge of *Assistant* Cleveland Abbe, A.M., *First* " *Assistant* Robert Craig, acting signal officer and assistant, and *Assistant* " T. B. Maury, A.M., who have been relieved and alternated in the dis- " charge of these and other special duties, at such times as directed under " the instructions of the Chief Signal Officer. The daily series of study- " charts are 12 in number." (Report for 1875, pp. 94, 95.)

" A regular course of study and practice is pursued by officers at this " office, in preparation for these duties. The charting of weather-maps is " practised, until the officer becomes thoroughly familiar with the process, " after which the preparation of deductions from the tri-daily reports is " commenced and made a continuous study.

" The tri-daily synopsis and probabilities have been issued from this " office, in the number explained in previous reports, with unfailing regu- " larity at 10.30 a.m., 6.30 p.m., and 1 a.m. daily; no case of omission or " serious delay having occurred during the year." (Report for 1875, p. 303.)

CANADA.—Twelve (12) persons in all; but of these the superintendent and three others are officers of the Toronto Observatory, of which the Meteorological Office is a recent outgrowth.

Question 12*a*.—*Have any of the staff any other sources of official income?*

AUSTRIA.—One of the adjuncts, Dr. Hann, is professor at the University, and derives from that an augmentation of salary.

HUNGARY.—The officers of the central Station are not allowed to undertake any other service at the same time.

BADEN.—No reply.

BAVARIA.—No reply.

BELGIUM.—No reply.

DENMARK.—The director and one of the assistants are retired officers.

FRANCE.—No reply.

HAMBURG.—No.

HOLLAND.—The director of the Marine Establishment is an officer of the Royal Navy.

ITALY.—See answer to question 12.

PORTUGAL.—The three observers are officers in the Navy, and have the corresponding pay.

PRUSSIA.—No reply.

RUSSIA.—No; except the director, as member of the Academy of Sciences.

SAXONY.—The superintendent is also superintendent of the Observatory, and the Meteorological Department is only a subordinate department. The book-keeper is also employed on the railway. The assistant is occupied with meteorology only.

SWEDEN.—The amanuensis is also a teacher at the Military High School.

NORWAY.—No.

SWITZERLAND.—One of the latter performs certain duties at the Observatory.

United States.—See answer to question 6. What is paid to those on the staff, who do not belong to the Army, is not stated.

Canada.—The superintendent and the three observatory assistants derive their income chiefly from the observatory.

Question 12b.—What are the usual office hours?

Austria.—The usual office hours are from 9 to 2 o'clock; but the staff not being sufficient for the work, the remaining business is performed in the afternoon.

Hungary.—According to circumstances, between 6 and 10 hours daily.

Baden.—No reply.

Bavaria.—No reply.

Belgium.—No reply.

Denmark.—9 a.m. to 4 p.m.

France.—No reply.

Hamburg.—Division I. and II. 9—3 o'clock. Division III. partly 9—4, partly 10—4 and 5¼—6½.

Holland.—From 9 till noon a.m., and from 1 to 4 p.m.

Italy.—See answer to question 12,

Portugal.—From 8 a.m. to 3.30.p.m.

Prussia.—No reply.

Russia.—9 a.m. to 4 p.m., with a little interval about 12 o'clock.

Saxony.—Every day from 10—1 and from 3—6.

Sweden.—10—12 a.m., 6.30—7.30 p.m.

Norway.—10 a.m.—3 p.m.

Switzerland.—9—12 a.m., 2—5 p.m.

United States.—Rule "for the guidance of the officer, assistant, or other person charged with the preparation of the synopsis and probabilities for publication."

"He will be at the office by 9.30 a.m., and 6.30 p.m., and 11.30 "p.m. of each day." (Report for 1873, p. 365.)

Canada.—The office hours are strictly from 10 a.m to p.m.; but work requiring part of the staff is going on from 6 a.m. until 1 a.m. of the following day.

Question 12c.—Is residence or any other special advantage enjoyed by the director or any of the staff?

Austria.—The director, the three adjuncts, the assistant, the messenger, and the gardener have free lodgings at the Central Institute.

Hungary.—The director, the senior observer, and the messenger have an official residence. The second observer receives 20*l.* for lodging money.

Baden.—No.

Bavaria.—No reply.

Belgium.—No reply.

Denmark.—The director and custodian have free quarters.

France.—No reply.

Hamburg.—No. They receive, however, an addition for residence, according to the Government regulations.

Holland.—Only the director of the observatory.

Italy.—See answer to Question 12.

Portugal.—The director has the special advantage of 90*l.* a year. The present director gives it over to the extraordinary expenses of the observatory.

Prussia.—No reply.

Russia.—Director, secretary, and office-keeper have an official residence in the observatory.

Saxony.—The superintendent has an official residence as being superintendent of the observatory. The assistants have no residence provided.

Sweden.—No.

Norway.—No.

Switzerland.—One of the assistants resides in the observatory (where the Central Institute has hitherto been located).

United States.—No reply.

CANADA.—Residences are not allowed, except to those who are officers of the observatory, and in virtue of their connexion therewith.

Question 13.—*How is the work divided at the Central Office?*

AUSTRIA.—There is no fixed division of the work at the Central Institute, generally the director takes care of the correspondence, of the relations to the several branches of Government and to Foreign Institutes, he is responsible for the funds granted to the Central Institute for the instruments and all materials. One of the adjuncts, aided by the assistant, has to take care of the several registering apparatus and of preparing the publication of the Jahrbuch. Another, of the magnetical instruments and observation, the third of the library, &c. The calculators are employed for reductions, revision of observation, copying, sending of parcels, &c.

HUNGARY.—Director, administration, correspondence with observers and officials, magnetic observations. Observers, daily observations at the Central Office, discussion of the station observations for the year book.

BADEN.—No reply.

BAVARIA.—No reply.

BELGIUM.—No reply.

DENMARK.—The Director has the General Superintendence, correspondence with the authorities at home and abroad, special superintendence of stations in the colonies. The first assistant superintends the instruments and the stations of the kingdom, the second assistant has the telegraphic service and hydrographical researches.*

FRANCE.—No reply.

HAMBURG.—See Instructions for General Marine Observatory.

HOLLAND.—By the Superintendent.

ITALY.—See answer to Question 12.

PORTUGAL.—The Meteorological and magnetic work is done by the observers assisted by the adjuncts.

PRUSSIA.—No reply.

RUSSIA.—Meteorological and magnetic observations in St. Petersburg, land meteorology, sea meteorology, weather reports, and storm warnings, various investigations.

SAXONY.—The book-keeper receives and revises the tables, the assistant prepares the data for the press, and the Superintendent gives the resumé and directs the whole.

SWEDEN.—The work is equally divided, except that the Director takes charge of the correspondence and of the administration. The calculators are only engaged upon the regular observations.

NORWAY.—1st assistant. Telegrams, verifications, computations. 2nd assistants. Reduction and control of barometric observations. 3rd assistant. Reduction of thermometrical and psychrometrical observations. 4th assistant. Reduction of wind and weather observations.

SWITZERLAND.—The chief of the office superintends and critically examines the obseavations and directs the publications. The assistants make the needful calculations, &c.

UNITED STATES.—Full answers to this question will be found in the Chief Signal Officer's Report for 1873.

CANADA.—While each branch is usually performed by one or by two persons permanently detailed for it, it is the practice to make temporary transfers in case of unusual pressure on one branch, and to provide for future cases of absence. It is to be understood that there is much miscellaneous work besides that stated under the following heads, in which every person has occasionally a share:

Examination and tabulation of written reports	2
Weather maps and probabilities	2
Correspondence and records of storms	1
Examination of instruments and visitation	1
Mechanician	1
Disposable	3

* By "hydrographical researches" are implied investigations into currents, sea temperature, &c., on the coast of Denmark.

Question 14.—*Who appoints the clerks?*

Austria.—The word "clerks" seem not to apply properly to the adjuncts and assistants of our scientific staff. The adjuncts are appointed by the Minister of Public Instruction. The assistants, by the Director of the Central Institute, the account clerk, messenger, and gardener are appointed by the Lieutenant (Governor) of the province. The calculators, telegraphist, and photographer are appointed by the Director.

Hungary.—The Minister of Instruction and Public Worship at the suggestion of the Director. The director is nominated by the Academy of Sciences and by the King.

Baden.—No reply.

Bavaria.—No reply.

Belgium.—No reply.

Denmark.—The two assistants are appointed by the Government. The calculator, &c., by the Director.

France.—No reply.

Hamburg.—The Imperial Admiralty.

Holland.—The Superintendent.

Italy.—See answer to Question 12.

Portugal.—The Government.

Prussia.—No reply.

Russia.—The Director of the Central Observatory.

Saxony.—The Superintendent.

Sweden.—The calculators are appointed by the Central Institute. The amanuensis by the Royal Academy of Sciences.

Norway.—The 1st assistant by the University, the other three by the Director.

Switzerland.—The Meteorological Commission.

United States.—No reply.

Canada.—The clerks are selected by the superintendent, subject to the approval of the Marine Department.

Question 15.—*What salaries are paid to the clerks and to the superintendent?*

	By Government.	By Central Institute.
Austria.—Director	£312	
Adjuncts (each)	132 to 165	
Assistant	58	
Accountant clerk	65	
Calculator's (each)	61	
Telegraphist	—	£65
Photographer	—	43
Messenger	45	
Gardener	50	
Hungary.—Director		£180
With quinquennial advance of		20
Observer		115
With quinquennial advance of		10
Messenger		35

Baden.—Superintendent, 86*l.* a year.
The calculator has no fixed salary.

Bavaria.—No reply.

Belgium.—No reply.

Denmark.—Director, 112*l.* and house,
1st assistant, 112*l.*
2nd do 64*l.*

France.—No reply.

Hamburg.—Superintendent of Division, 225*l.*, rising to 255*l.*
Assistants, 120*l.*, rising to 150*l.*

Holland.—The total of salaries must be brought to 833*l.*

Italy.—See answer to Question 12.

Portugal.—Every adjunct has 80*l.* a year. The superintendent is director.

Prussia.—No reply.

Russia.—Director 532*l.*, besides the Academy salary.
Assistant, 378*l.*; secretary, 112.
Each physicist, 168*l.*; mechanic, 70*l.*
Each observer, 112*l.*; office keeper, 70*l.*; calculator, 56.

Saxony.—The superintendent receives a salary of 60*l.*
The book-keeper, about 75*l.*
The assistant, 60*l.*

Sweden.—The calculators receive payment according to their work. The amanuensis has 140*l.* a year. There is no superintendent.

Norway.—Superintendent, as Professor at the University, 270*l.*
1st assistant, 133*l.*
2nd do. 80*l.*
3rd do. 70*l.*
4th do. 50*l.*

Switzerland.—Superintendent, 160*l.*
Assistants, 60*l.*

United States.—The colonel of the Signal Service Corps (Chief Signal Officer,) who has charge of the Meteorological Service, receives 700*l.** The rest of the staff consists of army officers temporarily detached from their regiments.

Canada.—The chief assistant receives about 300*l.*, and the clerks from about 40*l.* to about 160*l.*
The superintendent receives 200*l.* only, as he derives his income chiefly from another official source.
The rate of payment to assistant is to be regarded as only temporary.

Question 16.—*Who pays these?*

Austria.—See previous answer.

Hungary.—The Royal Hungarian Government. The Budget is annually voted by the Reichstag.

Baden.—The Grand Ducal Ministry of Commerce.

Bavaria.—No reply.

Belgium.—No reply.

Denmark.—The Institute pays.

France.—No reply.

Hamburg.—The German Empire.

Holland.—The Home Department.

Italy.—See answer to Question 12.

Portugal.—The Government.

Prussia.—No reply.

Russia.—The Treasury.

Saxony.—The State.

Sweden.—The Central Institute.

Norway.—The superintendent. The University pays the Superintendent. The Institute pays the Assistants.

Switzerland.—The Meteorological Commission, out of the fund allotted to it.

United States.—The State.

Canada.—Salaries are paid from a grant by the Dominion Parliament, amounting at present to $37,000 or about 7,600*l.* sterling.

Question 16*a*.—*Are their appointments permanent, and is there any provision for superannuation?*

Austria.—The appointment of the Director, of the adjuncts, and of the account clerk are permanent, and there is a provision for superannuation, $\frac{1}{3}$ of the salary, for every five completed years of service beginning with the end of the 10th year, and augmenting till the end of the 40th year.

Hungary.—Permanent. The director, observers, and messengers are entitled to pensions.

Baden.—No reply.

* Calculated at 5 dollars to the £.

Bavaria.—No reply.
Belgium.—No reply.
Denmark.—The organization of the Institute is as yet only provisional.
France.—No reply.
Hamburg.—Partly permanent, partly provisional.
Holland.—No, only as long as they are of service.
Italy.—See answer to Question 12.
Portugal.—Permanent.
Prussia.—No reply.
Russia.—Permanent, with a full pension after 25 years' service.
Saxony.—No.
Sweden.—The two officers are permanent. No pension.
Norway.—No.
Switzerland.—There is no provision of this kind. The latter matter rests with the Meteorological Commission.
United States.—In his report for 1875, p. 109, the Chief Signal Officer recommends that the non-commissioned officers and privates in charge of Stations should have their pay increased as follows:—

Serjeants to - - -	34	dollars per month.
Corporals - - - -	21	,,
Privates, 1st class - - -	18	,,
,, 2nd class - - -	13	,,

Canada.—At present the appointments are not permanent and there is therefore no provision for superannuation.

Question 16*b*.—*Are there any extra allowances, e.g., for additional work or special services?*

Austria.—There are some extra allowances for the telegraphist, for the calculators, and for the messenger, but none for the scientific staff.
Hungary.—Extra allowances are not made.
Baden.—Only the allowances for travelling expenses paid extra.
Bavaria.—No reply.
Belgium.—No reply.
Denmark.—No.
France.—No reply.
Hamburg.—Yes.
Holland.—No reply.
Italy.—See answer to Question 12,
Portugal.—Extraordinary work bringing nearly 1*l*. per month to each one.
Prussia.—No reply
Russia.—Yes.
Saxony.—Yes, for special services.
Sweden.—No.
Norway.—Only for private business.
Switzerland.—No reply.
United States.—No reply.
Canada.—No extra allowances are made.

Question 17.—*What Publications issue from the Central Office?*

Austria.—The publications issued by the Central Institute are the following:—

(*a*.) The "Jahrbücher" (Meteorological Annals) of the "Central Anstalt."
1st Series, 8 vols., 1848–56 (published by the Academy of Sciences).
2nd Series, till now 10 vols., 1864 to 1873.
For the years 1857–63 tables of monthly and yearly results have been published in the Proceedings of the Imperial Academy.

(*b*.) The observations made at the Central Institute published monthly by the Academy of Sciences in their Anzeiger.

(*c*.) A lithographed bulletin of Telegraphic Weather Reports, (without charts giving the isobars, &c.)

HUNGARY.—I. Meteorological Year Books containing monthly and yearly reports, summarized, from all the stations.

II. The daily observations of the central station in printed monthly reports.

BADEN.—Yearly reports, besides every month a summary in the "Carlsruher Zeitung."

BAVARIA.—Every month the observations are published by the Central Station. For many years past these have been worked up into the form of scientific papers.

BELGIUM.—No reply.

DENMARK.—Daily Bulletin of the weather, Bulletin du Nord bi-monthly, monthly resumé of the observations. Annual Report.

FRANCE.—No reply.

HAMBURG.—From Division III.

I. Daily Weather Report.

(*a.*) Lithographed in two sheets.

(*b.*) Telegraphic Reports to newspapers.

(*c.*) To the harbours.

(*d.*) Meteorological observations for Hamburg supplied to a Hamburg newspaper.

II. Monthly summary of weather.

III. Jahrbuch and Annual Report.

IV. Special announcements in the "Annals of Hydrography."

Each of the other divisions issue reports, Wind Charts, Sailing Directions, Division I., and the results of the observations on Magnetic Phenomena, Division II.; Division IV., on chronometers.

HOLLAND.—(*a.*) The publications of the observations in the country.

(*b.*) An international publication extending over as large a part of the world as our means permit.

(*c.*) Tracks for ships, statistics of the ocean.

ITALY.—*Bolletino decadico*, published every 10 days; *Bollettino mensile*, published every month; *Supplements* issued annually.

PORTUGAL.—The Annaes do Observatorio do Infante D. Luiz and Annaes dos Postos Meteorologicos.

PRUSSIA.—No reply.

RUSSIA.—Annals of the Central Physical Observatory.

SAXONY.—1 Monthly Summaries.

2 Results of the Observations of the Meteorological Stations, year I. to VIII.

SWEDEN.—The periodicals are,—

1. Met. Jakttagelser i Sverige.
2. Bull. Mét. du Nord (in connexion with Norway and Denmark).
3. Väderleks Bulletin.

NORWAY.—A Jahrbuch; a daily bulletin posted up and sent to the papers; Bulletin du Nord in conjunction with Sweden and Denmark; a monthly review in an agricultural periodical.

SWITZERLAND.—The Schweizerische Met. Beobachtungen, which has appeared since 1864.

UNITED STATES.—In the Report for 1875, p. 771, the following list of publications during the year is as follows:—

Farmers' Bulletins	235,023
Bulletins manifold	18,134
Maps	141,223
Weekly Chronicles	28,621
Monthly weather review	171,408
International Bulletins	110,665
Board of Health Reports	290

CANADA.—In the annual report to the Marine Department are printed, for every day in the year, *three* reports from 13 telegraphic stations, the observations being at 7.25 a.m., 4.25 p.m., and 10.50 p.m. (Toronto time), and *one* report daily from 11 stations, observations at 7.25 a.m. In the same report are also printed tables of monthly means, and, for some stations, tables of daily means.

Weather maps and probabilities are issued daily, but as yet they have not been printed.

Miscellaneous papers are also occasionally issued.

Question 17a.—From what fund is the printing paid?

Austria.—The costs of publications are defrayed from the general fund (dotation) granted to the Central Institute.

Hungary.—From the budget of the Office, noted as Chancery expenses, 90*l.* a year.

Baden.—Payment supplied to the Ministry of Commerce.

Bavaria.—By the Government Department of Finance.

Belgium.—No reply.

Denmark.—The Institute pays for the printing.

France.—No reply.

Hamburg.—For 1, (*a*), and 3 the Marine Observatory pays: for 1, (*b*), and (*d*) the newspaper editors; for 2 and 4 partly the Marine Observatory, partly the Admiralty.

Each of the other Division issues reports: Wind charts and sailing directions, Division I.; and the results of observations on magnetic phenomena, Division II.; Division IV., on chronometers.

Holland.—From the Home Department.

Italy.—The expenses of the publications are charged to the budget of the Ministry of Agriculture and Commerce, Division of Statistics.

Portugal.—From the budget of the Observatory, nearly 165*l.* per annum.

Prussia.—No reply.

Russia.—Out of a special printing fund of the Central Observatory.

Saxony.—Out of the funds of the year.

Sweden.—1. By the Royal Academy of Science.

2. One third of the cost by the Meteorological Central Institute.

3. By a private publisher, who at present receives a subsidy from the State.

Norway.—The grant to the Institute.

Switzerland.—Out of the fund supplied by the Government to the Meteorological Commission.

United States.—Funds provided by the State.

Canada.—The annual report is issued at the cost of the fund for printing Parliamentary and Departmental reports; but casual papers and those issued at short intervals are printed at the cost of the Central Office.

Question 17b.—How many copies of your publications are distributed free?

Austria.—Copies of the Meteorological Annals are distributed—

(*a.*) To observers at 138 Austrian stations. (138.)

(*b.*) To the Hungarian Meteorological Central Institute. (20.)

(*c.*) To institutes, offices, meteorologists in Austria and in foreign countries. (260.)

Hungary.—(*a.*) 128 copies to observatories, corporations and private persons.

(*b.*) 98 copies to all the stations of Hungary.

(*c.*) 12 copies to Austrian stations.

238 copies in all.

Baden.—About 200 copies.

Bavaria.—20 every month.

Belgium.—No reply.

Denmark—Daily bulletin, 30 copies.

Monthly resumé, 240 copies.

Annual Report, 300 copies.

France.—No reply.

Hamburg.—About 125 (this refers only to weather reports).

Holland.—They are nearly all distributed free. Every distinguished meteorologist receives the former publications, every co-operator the latter (Marine section).

Italy.—More than 400 copies are distributed gratis to the Observatories, to the Institutes of Instruction, and abroad.

PORTUGAL.—All.
PRUSSIA.—No reply.
RUSSIA.—400.
SAXONY.—150 copies.
SWEDEN.—1. 82 in Sweden and 185 abroad.
2. Are distributed by the Danish Institute.
3. 25 copies.
NORWAY.—About 300 of the Year Book.
SWITZERLAND.—About 180.
UNITED STATES.—No reply.
CANADA.—About 500 copies of the last annual report were given away.

Question 17*c*.—*How many are sold?*

AUSTRIA.—Not more than 10 or 12 copies are sold.
HUNGARY.—Hitherto no copies have been sold.
BADEN.—They are published by Braun, Hofbuchhändler in Carlsruhe.
BAVARIA.—No reply.
BELGIUM.—No reply.
DENMARK.—Daily bulletin, 250 copies.
Monthly resumé, 20 „
Annual report, 15 „
FRANCE.—No reply.
HAMBURG.—About 100.
HOLLAND.—Not a dozen a year.
ITALY.—No reply.
PORTUGAL.—None.
PRUSSIA.—No reply.
RUSSIA.—None.
SAXONY.—About 50 copies.
SWEDEN.—1. Unknown.
2. See Denmark.
3. 150 copies.
NORWAY.—None.
SWITZERLAND.—60.
UNITED STATES.—No reply.
CANADA.—None were sold.

Question 18.—*Are there daily observations published from any stations as well as average (weekly or monthly), and if so from how many stations?*

AUSTRIA.—Daily observations are published from 14 stations (10 in Austria, and 4 in Turkey, Egypt, and Greece), these daily observations from the 1st part of the Jahrbueh. Separate copies are sent to the several institutes about a fortnight after the close of every month. Averages from all stations connected with the Central Institute are published in 2nd part of the Jahrbuch.
HUNGARY.—Owing to lack of funds at present only from the central station and from Fiume, the latter being paid for by the Adria Commission. The Central Office receives telegrams daily from 12 Hungarian, 4 Austrian, and 1 Turkish station (7 a.m.), which are published in several newspapers.
BADEN.—Daily observations from Carlsruhe in two newspapers published here. Monthly reports from all the stations in the "Carlsruher Zeitung."
BAVARIA.—The Munich Observatory.
BELGIUM.—No reply.
DENMARK.—The observations of 16 stations of the 2nd order are published *in extenso;* of the other only the monthly and annual averages.
FRANCE.—No reply.
HAMBURG.—Besides the telegraphic bulletins only Hamburg in the Hamburg "Börsenhalle;" at the end of the year all the stations of the 1st order in the Jahrbuch (only for the observations of weather).
HOLLAND.—From the 10 indicated stations I publish the observations for 3 hours; from the 30 stations of the 4th order only once a day. I have

copies ready of the hourly observations at Helder, Groningen, Utrecht, Amsterdam, &c.

ITALY.—No reply.

PORTUGAL.—The 9 a.m. observations of this observatory, of the continental stations and Funchal are daily published in the Government Journal and in other newspapers.

PRUSSIA.—No reply.

RUSSIA.—From all stations of the 1st and 2nd order.

SAXONY.—Yes, daily from the Central Station. Monthly and yearly summaries from the stations of the 2nd and 3rd order.

SWEDEN.—From 9 stations observations are published daily in the Bulletin Met. du Nord, and in the Vadeleks Bulletin, and in the newspapers. Monthly in the Stockholm paper "Afton Bladt." The monthly average of temperature at 8 a.m., and the total of rainfall for 17 stations.

NORWAY.—Daily for 12 stations. Averages for about 30 stations (in the Jahrbuch).

SWITZERLAND.—From 15 stations the observations are printed in full; from about 30 others daily averages, &c. From the rest, monthly summaries.

UNITED STATES.—No reply.

CANADA.—For answer, see Question 17.

Question 19.—*Is provision made for the discussion of particular points in reference to storms, weather, public health, agriculture, &c., or in reference to more scientific questions?*

AUSTRIA.—The discussion of particular points in reference to storms, &c. is left as free and voluntary work to the different persons constituting the scientific staff. The Journal of the Austrian Meteorological Society is the usual publication in which questions of this nature are discussed.

HUNGARY.—By several observers phenological observations are made with special reference to agriculture which are published in the Jahrbücher. A comparison of the relation between disease and meteorological conditions is periodically published by the Statistical Bureau of Vienna.

BADEN.—No.

BAVARIA.—The official stations of the 2nd order are specially appointed for agriculture and forest purposes.

BELGIUM.—No reply.

DENMARK.—The study of the great movements of the atmosphere has been prepared by the construction of synoptical charts, embracing the whole of Europe, since the commencement of 1867. The distribution of rain over the country with the different winds is specially studied.

FRANCE.—No reply.

HAMBURGH.—Yes.

HOLLAND.—Certainly.

ITALY.—No reply.

PORTUGAL.—No.

PRUSSIA.—No reply.

RUSSIA.—The director, his assistant, and the physicists are pledged to do such work. The results are published in the *Repertorium für Meteorologie* brought out by the Academy of Sciences.

SAXONY.—No. However the influence of the climate on agriculture and the economy of forests is to be ascertained, this being a matter for the superintendent to decide.

SWEDEN.—The collected material is worked up into scientific papers. Of these have appeared:—(1.) *Edlund:* Contributions to the knowledge of the climate of Sweden. (2.) *Rubenson* on the amount of the rainfall in Sweden, &c. Presented to the Academy, but not yet printed are: (1.) *Rubenson* monthly and yearly averages of temperature. (2.) *The same* on the daily variations of temperature. (3.) *Forssmann* on the high-water observations instituted on the Swedish Coast.

NORWAY.—It is left to the time the director may find for such.

SWITZERLAND.—The discussion of materials has been provided for and is in part commenced.

United States.—In the Report for the year 1875, p. 96, it is stated, that "During this period 1,023 signals have been ordered, counting each "separate display at each port a separate signal, in anticipation of 67 "dangerous *storms*. Of this number 76 per cent. have been afterwards "reported as verified by the occurrence of dangerous winds at the "points where the signals were displayed, or within a radius of 100 "miles from these points."

"The effort has been continued during the year to exhibit as widely "as possible in the *agricultural* districts the results of the daily Office "studies, in the form of printed forecasts, for the benefit of the agri-"cultural population of the United States. The continuance of this "work has seemed to be warranted by the favour with which it has been "received. By an arrangement with the Post Office Department, "6,364 printed farmers' bulletins, on which have appeared the daily "reports of this Office, have been distributed and displayed in frames "daily, at as many different post offices in different cities, villages, and "hamlets in different States. At midnight of each day, the midnight "report of the Office for the ensuing day is telegraphed to 20 centres "of distribution, as follows: These have been carefully selected as "located in the midst of the denser agricultural populations of the "States, and at points where facilities of communication enabled the "surrounding districts to be most rapidly supplied. The telegraphic "report received at a centre of distribution is at once printed by "enlisted men of the Signal Service, on bulletin forms provided for "that purpose, enveloped as rapidly as printed, addressed to each "designated post office within the district to be supplied, and which "can be reached by the swiftest conveyance by the hour of 2 p.m. of "the date, and are then placed in charge of the Post Office Depart-"ment, under an arrangement by which each postmaster receiving the "bulletin has the order of the Postmaster General to display it instantly "in a frame provided by this Office for the purpose, and to report the "fact of its receipt and of its display in writing to the chief signal "officer.

"The average hour at which the bulletins have reached each of the "different post offices, and have been displayed in the frames, has been "11 a.m. It is difficult to estimate the number of people and the "varied interests it has been attempted in this way to benefit."

Canada.—Weather maps are constructed daily for the whole continent for each of the three telegraph hours, and are studied with a view of advancing a knowledge of the principles of prognostication as well as for prognostication relating to the immediate future.

The importance of discussions regarding health, agriculture, &c. &c., and sundry scientific questions is fully recognised; but as the value of such discussions depends (ceteris paribus) on the correctness of observations, the number and territorial distribution of good stations, and the number of years in which observations are carried on, it has been thought better to employ the strength of the Office in improving the data rather than in drawing premature conclusions from them.

Question 20.—Have any researches been carried on with a view to the improvement of instruments or methods of reducing observations?

Austria.—Attention has been directed, of course, to the improvement of instruments and of the methods of reducing observations. With regard to instruments, the Adjunct Professor Osnaghi has been busy with the construction of new, and the improvement of already existing, instruments. Of the methods of reduction the simplest have been found to answer best.

Hungary.—For ascertaining the formulæ of reduction for air pressure and temperature there exists lithographed material extending over 12 years; but the staff for calculating them is wanting. The formulas of reduction drawn out by Jelinek ("Ueber den täglichen Gang der vorzüglichsten Meteor. Elementen") are provisionally in use.

Baden.—No reply.

Bavaria.—At the Central Station.

Belgium.—No reply.

Denmark.—A new anemometer is in course of being tested.

France.—No reply.

Hamburg.—Among such researches must especially be mentioned the supply of the stations with instruments last summer; the result was, very special directions given to the mechanicians with reference to each of the instruments; the researches are being carried on, especially as regards the equipment of the stations.

Holland.—Not particularly with a view to the improvement of instruments.

Italy.—No reply.

Portugal.—Yes, especially as to the best mounting of the psychrometer.

Prussia.—No reply.

Russia.—(See answer to Question 19.)

Saxony.—Yes; but in general the methods are altered according to the resolutions of the Congress of Vienna.

Sweden.—No.

Norway.—The locality has hitherto forbidden such investigations.

Switzerland.—Various researches are to be found in the Appendices to the yearly volumes.

United States.—"A model rain-gauge, a model anemoscope, and a model "mechanical barometer, all self-registering, and arranged upon plans "not known to have been before used, have been constructed at the "office, and are now undergoing the usual tests." (Report for 1875.)

Canada.—Attention has been turned to the contrivance and improvement of apparatus, and specially of anemometers.

Question 21.—*What is the cost of the Meteorological Department under all its different heads?* (1.) *For instruments.* (2.) *For stations.* (3.) *For observers.* (4.) *For cost of records.* (5.) *For transmission to Central Office.* (6.) *For verification of observations.* (7.) *For publication of results.* (8.) *For warnings of storms.* (9.) *For abstract physical or scientific results.*

Austria.—The wants of a Central Meteorological Institute are changing every year, and the more so if the funds granted to it in former years have been low beyond measure, and if the relations of the Institute have been totally altered by the erection of a new building for the observatory, (1870–72) and the erection of many new self-registering instruments. It seems therefore advisable not to communicate the fixed sums granted systematically to the Central Institute (to which supplementary grants have been added) but the funds asked from the Government for the year 1877.

(1.) Instruments, library, &c. - - - -	£280
(2.) Instruments for stations, carriage of instruments, &c. -	58
(3.) Small remunerations to some observers - - -	25
(4.) Records, printing of forms for entering the observations -	17
(5.) For messengers carrying the telegrams to the telegraph office at eight stations - - - - -	20
(6.) Verification for inspections - - - -	50
(7.) Publication of Jahrbuch and lithographed bulletin -	178
(8.) Warnings of storms. There are no warnings in the proper sense in Austria. The Meteorological Telegrams are transmitted free of cost. Forms for telegraphic records, &c., and pay of telegraphist - - -	77
(9.) There is no fund for abstract physical or scientific results. Practically application must be made to the Academy of Sciences or to the Meteorological Society.	
Total -	£705

From the total sum of 705*l.* there have to be subtracted the remuneration given to the photographer and to the telegraphist (43*l.* and 65*l.*) as already mentioned in answers to Question 15. If this is done the total sum will be 597*l.*

There are still other costs: (*a*), for conservation and repair of the premises, 42*l.*; (*b*), for fuel, 55*l.*; (*c*), for gas in the office, on the stairs, in the corridors &c., for cleaning and keeping up the garden, 83*l.*; total, 180*l.* The total expenses of the Meteorological Institute under all its different heads are therefore:

A. For the staff - - - -	£1,220
B. For the Central Institute and the stations	597
C. For the premises and the garden - -	180
Total -	1,997

HUNGARY.—(1.) (2.) £200 Central Office and stations.
(3.) 100
(4.) (5.) (6.) are defrayed out of the sum for Chancery expenses.
(7.) 40
(8.)
(9.)

The entire budget, including salaries, rent, &c., 1,300*l.*

BADEN.—Not known.

BAVARIA.—(1.) £186 (2.) 122 expenses of outfit.
(3.) 87 (4.) 19 (5.) — (6.) — (7.) 8 10*s.* yearly maintenance.
(8.)
(9.)

BELGIUM.—There is no office created specially with reference to the study of meteorology. The labours of the Royal Observatory are divided between two distinct services, the astronomical and the meteorological; but the grant which is allowed each year to the Observatory is common to both, and is subdivided as follows:

Staff - - - - - - - -	£742
Material (*i.e.*, printing, purchase of instruments and works, miscellaneous expenses, &c.) - - -	322
	1,064

DENMARK.—The budget of the year 1875 may be divided as follows:

Director, two assistants - - - -	£292
Draughtsman and calculators - - -	120
Instruments and stations - - -	105
Printing of lists, &c. - - - -	96
Library - - - - - -	38
Office custodian - - - -	75
Observers - - - - -	99
Journeys of inspection - - - -	30
	855

FRANCE.—No special budget. The expenses of land observations are defrayed out of the vote for the National Observatory; those of maritime observations out of the Navy vote.

HAMBURG.—Expenses of the Central Station building, repairs, and travelling expenses - - - - - - £650
Expense of telegraphic reports - - - - - 1,500
For instruments, models, books, charts, and publications - 900
Office expenses of the agencies, and for keeping their books - 125

HOLLAND.—I have not so large a sum at my disposal that strictly defined sums should be allowed under so many heads. Till now we have never paid more for the staff, clerks, and personal assistance in general than - - - - - - - - - £625
And for instruments, publications, different costs - - 583

1,208

However, the director of the Marine section and I have each from other sources about 167*l.* - - - say 375
Telegrams which are paid by the Government - - - 500

Total, all included - £2,083

ITALY.—No reply.

PORTUGAL.—(1.) £112
(2.) —
(3.) 216
(4.) 15
(5.) —
(6.) —
(7.) 90
(8.) —
(9.) —

PRUSSIA.—For salaries of one councillor and one assistant, including an allowance to the latter for house rent - - - - £372
For all other personal expenses, remunerations to watchers at the different meteorological stations - - - - 825
Remuneration for special services - - - - 15
For repairs of meteorological apparatus, for stationery, printing, bookbinding, and travelling expenses - - - 278

Total - £1,490

It may be observed that besides the special Meteorological Institutions of the remaining German States, the Hydrographic Department and the German Lighthouse Department, both of which are under the control of the Minister of Marine, are connected with the Meteorological Institute. Their respective costs are, for 1876—

For the Hydrographic Department - - £6,922
„ Lighthouse - - - - 6,514

A new observatory is in course of erection at Potsdam.

RUSSIA.—Yearly credit of the Central Observatory at St. Petersburg, for the time being, 6,300*l.* The weather telegrams are quite free and may be estimated at 7,700*l.* a year. The outlay on the other hand for meteorology and earth magnetism may be computed at 5,600*l.* This principally concerns the other stations of the 1st order, Tiflis, Pekin, Barnaul, &c.

SAXONY.—About 750*l.*
(1.) about £100
(2.) „ 30
(3.) „ 250
(4.) „ 75
(5.) } „ 75
(6.) }
(7.) „ 90
(8.) „ —
(9.) „ —

SWEDEN.—1,098*l.*, viz. :—

	£	s
Salary of director - - -	281	5
,, amanuensis - - -	140	0
,, the observers - - -	371	5
Calculations - - - -	84	5
Servants - - - - -	39	5
Instruments for private stations - -	56	0
Other expenses - - - -	125	0
Total -	£1,098	0

NORWAY.—1,080*l.*

I am not able to class the cost under these heads exactly. The annual grant is 1,080*l.*, of which 480*l.* is for expenditure for instruments, printing, house rent, tours of inspection, &c., and the rest is for salaries to officials and observers. Telegraphy is free.

SWITZERLAND.—About 640*l.* per annum.

(1.) £32
(2.) 40
(3.) 32
(4.) —
(5.) 16
(6.) 280
(7.) 240
(8.) —
(9.) —

UNITED STATES.—The following are the returns of sums expended by the Signal Office during the fiscal year 1874–5 :

For the maintenance of stations already existing and establishment of new stations - - - -	£25,660
For manufacture, purchase, and repair of meteorological instruments and storm signals - - - -	3,260
For publication and distribution of maps, bulletins, &c. -	13,460
For construction of telegraph lines - - -	20,800
For cost of telegrams and postage communication -	39,662
	£*102,842

CANADA.—It is impossible to state in each case the cost of the several heads (1) to (9). For example, the cost of stations, as distinct from salaries of observers, cannot be separated from that of instruments, or from that of records (by which I understand register forms, &c.). Again, the cost of the verification of the observations, and of abstract physical results, is mixed up with that of the salaries at the Central Office, and of the appliances employed there.

As far as it is possible to give them, the details are approximately as follows; but it may be stated that the figures will be greatly modified in future, the cost of the instruments being reduced, and that of visitation and telegraphy being increased :—

1.	Instruments - - - - -	£900
2.	Visitation of stations - - - -	80
3.	Salaries of observers - - - -	1,800
	Drum agents - - - - -	85
4.	Stationery, including forms - - -	260
5.	Postage, including transmission of records -	100
6.	?	
7.	See 17*a*.	
8.	Telegraphy, including *collection* of data, as well as issue of warnings - - - -	2,000
9.	?	

* Calculated at 5 dollars to the £.

Question 22.—Does your Department deal with both Land and Ocean Meteorology?

Austria.—The work of the Austrian Central Meteorological Institute is confined to Land Meteorology only; it includes however, magnetical determinations, and more especially observations of the variations of the three magnetic elements, and absolute magnetic determinations, to be made regularly every month at Vienna, and from time to time in the whole Austrian monarchy.

Hungary.—Only with Land Meteorology.

Baden—No.

Bavaria.—With Land Meteorology only.

Belgium.—No reply.

Denmark.—Until now only with the 1st branch of meteorology. Hydrographic researches have however commenced with the year 1876.

France.—No reply.

Hamburg.—Division I. Maritime Meteorology. Division II. Instruments (Literature) (Deviation). III. Coast Meteorology and warnings of storms. IV. Institute for the verification of chronometers.

Holland.—No reply.

Italy.—No reply.

Portugal.—Yes.

Prussia.—No reply.

Russia.—Yes, but only starting from this year.

Saxony.—No.

Sweden.—Yes, at present; but it is decided to erect a separate Nautical Meteorological Bureau.

Norway.—The dealing with Ocean Meteorology is very little. Some observations of temperature of the sea have been discussed. (In future years I intend to propose a special building for the Institute; an observatory of the first order (far from the town); a larger staff of clerks; a division for Ocean Meteorology; an extension of the storm warning system.)

Switzerland.—The latter naturally has nothing to do with us.

United States.—No reply.

Canada.—Nothing has been done with reference to Ocean Meteorology, but it is probable that ships' logs will be collected to aid in the study of storms.

APPENDIX VI.

Report of the Third Committee.

First Meeting, 15th April, at 11h. a.m.

Present:—MM. Mascart (President), Cantoni, de Brito-Capello, Houzeau, Mendeleef, Mohn, Palmieri, Schenzl, Snellen, Wild, and von Bezold (Secretary).

At the request of the President, Mr. Scott (Secretary to the Congress) submitted a list of the printed reports, &c. on the questions which had been referred to the Committee, viz., Nos. 12 and 16–25, and stated that the question of seismometry had also been referred to it.

The President opened the discussion upon question 10 of the Programme (Comparison of Standard Instruments).

M. Wild spoke upon the comparison of barometers, and gave a resumé of the ideas contained in his report.*

M. Cantoni thought it very desirable that barometers from three stations of Italy, for example, Rome, Naples, and Palermo, should be compared as proposed by M. Wild. In this sense Italy might take part in the realization of the scheme.

MM. Mendeleef, Houzeau, Mohn, and de Brito Capello, made some remarks upon this subject.

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* Rapports sur les questions du Programme, p. 37.

The resolution given at p. 12 was put to the vote and adopted.

The President opened the discussion upon Question 16 (the Determination of the fixed points of Thermometers).

MM. Cantoni, Wild, Snellen, and Mendeleef took part in the discussion.

The resolution given at p. 12 was put to the vote and adopted.

The discussion on questions 17 and 18 was adjourned.

The President opened the discussion upon Question 19 (Radiation).

MM. Cantoni, Palmieri, and Wild took part in the discussion.

The Committee adopted the resolution given at p. 13.

The discussion on questions 20 and 21 was adjourned,

The President opened the discussion upon question 22 (Rain Gauges).

MM. Mohn, Cantoni, v. Bezold, Palmieri, Snellen, and Zenger spoke upon this subject.

The Committee adopted the resolution given at p. 13.

The discussion on question 23 was adjourned.

The discussion was opened upon question 24 (Ozone).

MM. Cantoni and Palmieri made some remarks, and described the experiments which had been made in Italy upon this subject.*

M. Zenger described a new method which he had employed, based upon the use of hydriodic acid, contained in an apparatus with Liebig's bottles, through which the air was made to pass by means of an aspirator.

MM. Cantoni and Palmieri spoke of the great difficulties connected with an exact determination of ozone.

The resolution given at p. 15 was adopted,

The next meeting was fixed for Wednesday, 2h. p.m.

E. Mascart, President.
v. Bezold, Secretary.

Second Meeting, 16th April, at 2h. p.m.

Present :—MM. Mascart (President), Cantoni, de Brito-Capello, Houzeau, Mendeleef, Mohn, Palmièri, Schenzl, Snellen, Wild, and von Bezold (Secretary).

With reference to the protocols of the first meeting, the President communicated a letter from M. Marié-Davy to M. Buys Ballot, relative to M. Violle's report on radiation. This letter will be printed as a report to the Congress.†

The protocols were confirmed.

The President opened the discussion upon question 17 (Exposure of Thermometers).

M. de Brito-Capello remarked that he had presented a report upon this subject,‡ and that there was another by M. Wild.§

M. Cantoni proposed that the discussion of this question should be taken conjointly with that of question 20 (Humidity of the Air).‖

M. Wild added some remarks to his report on thermometer-screens.

M. Mohn expressed his satisfaction at finding that M. Wild did not recommend absolutely one definite form of screen, because it was often necessary to take the convenience of observers into account.

M. Wild was quite of the same opinion, and he insisted especially upon the bad effect of the wooden screens of large dimensions which retard the action of thermometers, a disadvantage which the small metal screens did not present.

M. Cantoni added that he had obtained good results with wooden screens when they were of very small size.

M. Houzeau communicated the general result of the comparisons which had been recently made at the Royal Observatory of Brussels with three different thermometers. The first was set up in the garden of the Observatory, placed in a wooden louvred screen of tolerably large size, and protected by

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* Rapports sur les questions du Programme, p. 83.
† Ibidem, p. 277.
‡ Ibidem, p. 267.
§ Ibidem, p. 48.
‖ Ibidem, p. 119.

the building from the direct action of the sun. The second was placed in the common centre of two hollow metal spheres, each composed of alternative bands and spaces, the bands of one sphere corresponding to the spaces of the other. Lastly, the third thermometer was a sling-thermometer (thermomètre-fronde), used in the open air, in the shade. The result of these comparisons has shown that these three thermometers often did not differ by more than a tenth of degree. This figure, 0°·1, will nearly measure the ordinary difference of these instruments.

M. Tacchini recommended the Committee not to take a definite decision on the form of screens for protecting thermometers; he spoke of the experiments which he had made at Palermo, and stated that wooden screens, whose dimensions were limited even to a metre, ought to be suppressed. He explained the form adopted, viz., "Il Balcone meteorico di Palermo," and which he had proposed for use at other stations; at the same time he acknowledged the very interesting communications of M. Wild.

The Committee adopted the resolution given at p. 12.

The discussion of question 18 of the Programme (Earth Temperature) was opened, and after some observations the resolution given at p. 13 was adopted.

The President opened the discussion upon question 20 (Humidity of the Air).

M. Cantoni read a report upon this subject.*

M. Wild explained some experiments which he had made upon this subject, and he thought it was desirable to add an aspirator, at least for the wet-bulb thermometer.

M. Cantoni made some remarks on the difficulties presented in determining the humidity of the air by means of the dry and wet bulb thermometers when the temperature is very near or below the freezing point.

M. von Bezold remarks that these difficulties were well known to him, and that they occur very frequently in colder climates. He proposed that, if possible, the addition of a hair hygrometer, for instance, that of Kappe, of Zurich, should be recommended.

M. Wild stated that, in Russia, hair-hygrometers were everywhere used by the side of the dry and wet bulb thermometers.

M. Snellen made the following communication upon this point: that while he liked the improvement introduced by M. Alluard in the manner of observing the dew-point when Regnault's condensation method is employed for determining the humidity of the air, he nevertheless thought that the same result might be arrived at in the following way: Place behind the vessel containing the ether, by the evaporation of which condensation is attained, a piece of dull blackened paper or other screen, at such a distance that the free circulation of the air shall be in no wise impeded. Then when the silver vessel is examined by means of a magnifying glass, the reflected image of the screen is seen on it, and quite close to it the screen itself; this allows of the accurate determination of the moment of condensation, in this manner; the separation between the vessel and the screen absolutely cannot be seen, at least as long as the surface of the vessel is well polished and no dew is deposited; but at the moment this latter case takes place the separation is immediately seen, the vessel taking a whitish glimmer, while the screen retains its first aspect.

The Committee adopted the resolution given at p. 13.

The meeting closed at 4h. p.m.

E. Mascart, President.
v. Bezold, Secretary.

Third Meeting, 17th April, 2h. p.m.

Present:—MM. Mascart (President), de Brito-Capello, Hoïzeau, Mendeleef, Mohn, Palmièra, Stenzl, Snellen, Wild, and von Bezold (Secretary).

The President opened the discussion on question 21 (Evaporation).

M. Cantoni made the following remarks:— The numerous experiments made in Italy by MM. Tacchini, Ragona, Frisiani, and myself, in recent

* Rapports sur les questions du Programme, p. 119.

years, and of which I have given a resumè of the results in a notice published with the Supplement to *Meteorologia Italiana*,* all tend to confirm the following principle :—

" We cannot have comparable atmometers unless all conditions of form are well established as to dimensions, construction, and exposure of the apparatus ; and it is especially necessary that they should be of small size."

After a short discussion, in which MM. Pittei, Wild, Denza, and Cantoni took part, the resolution given at p. 13 was adopted.

The Committee then discussed question 23 (Anemometers).

M. Wild gave an account of M. Dohrandt's investigations upon this subject.†

M. Mohn drew attention to the anemometer of M. Hagemann, of Copenhagen, which appeared to give very good results, at least when the velocity of the wind exceeded a certain rate.

M. Wild stated that he had also made some experiments with this anemometer, but they were not sufficient to enable him to give a definite opinion.

M. Snellen recommended the adoption of M. Spangenberg's method.

M. de Brito-Capello read a report upon this subject.

M. Plantamour regretted that the vertical component of the wind was not sufficiently observed. He was of opinion that this determination would be of the greatest interest, because it would enable us to ascertain the inclination of the wind.

M. Wild stated that he had made various experiments in this direction with a wind vane on a horizontal axis, which had given satisfactory results

M. Tacchini proposed the employment of a normal standard anemometer.

M. Weihrauch was of opinion that the construction of such an instrument was impossible, on account of the inevitable changes of friction.

M. Snellen was of the same opinion.

M. Houzeau requested that this question might be referred to the International Committee, who would undertake this comparison when it judged it opportune.

M. Wild recommended the transmission by post of one of the anemometers of Schulz of Dorpat, and that it should always be compared before and after a voyage with a normal instrument placed at a certain station, for instance, at St. Petersburg.

The Committee adopted the resolution given at p. 14.

The Committee proceeded to discuss question 25 (Atmospheric Electricity).

M. Mascart gave the Presidency to M. Cantoni.

M. Palmieri explained his views upon this subject, and gave a resumè of the works he had published thereupon.‡

M. Mascart did not share the opinion of M. Palmieri with respect to the continuity of observations, and he insisted upon the following points :

1°. It is necessary to make continuous observations on the phenomenon, because atmospheric electricity changes so very quickly.

2°. It is necessary to make sure always that the insulation is perfect.

3°. The continuous records should be elected by intermittent observations.

4°. It is necessary that the indications of the electrometer should be proportional to the intensity of the phenomenon observed, or at least that each electrometer should be furnished with a table of graduation.

M. Denza reported the experiments made with M. Palmieri's instruments at different places in Italy, and thought that those instruments might everywhere furnish satisfactory results.

After some remarks by MM. Mascart, Palmieri, Cantoni, Wild, &c., the Committee adopted the resolution given at p. 15.

The meeting closed at 4h. p.m.

E. Mascart, President.
v. Bezold, Secretary.

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* Rapports sur les questions du Programme, p. 123.
† Ibidem, p. 49.
‡ Ibidem, p. 261.

Fourth Meeting, 18th April, at 11h. a.m.

Present:—MM. Mascart (President), de Brito-Capello, Houzeau, Mohn, Mendeleef, Wild, and v. Bezold (Secretary).

The protocols of the last meeting were confirmed.

The President announced that he had received the following letter from Mr. Buchan on the exposure of thermometers:—

"Scottish Meteorological Society, Edinburgh,
April 14th, 1879.

"My dear Sir,

"I greatly regret that, owing to the effects of my accident in September, I have not been able to submit a report on question 17 to the Congress at Rome, as I hoped I should have been able to do in December, when requested to do so by the Permanent Committee.

"Even yet I could not undertake the preparation of such a report on account of the large and difficult question raised by the phrase 'destined to give the temperature of the air.'

"If the problem be a practicable one to devise some instrumental arrangements for the observation of the true temperature of the air, we are so far from an approximate solution of it as practically to shut us up to the adoption of a method of observation which will secure *uniformity*. Further we cannot meantime go.

"Some time ago Mr. Stevenson published a paper on this point which, as it meets my views, I take the liberty of subjoining.*

"I continue to make steady and satisfactory progress.

"Yours faithfully,
Alexander Buchan.

"R. H. Scott, Esq.,
"Secretary, Permanent Committee."

M. Zenger exhibited some photographs of the sky in the vicinity of the sun. At the request of one of the members, M. Zenger promised to give a note, which should be printed among the reports to the Congress.†

M. Mascart remarked that the circles shown by the photographs of M. Zenger appeared to be often the reproduction of invisible coronæ.

M. v. Bezold was of the same opinion, and he thought that it was desirable to determine the angular diameter of the circles.

M. Palmièri proposed to repeat the experiments of M. Zenger.

The President communicated to the Committee a work by M. de Rossi (La Meteorologia Endogena, Milan, 1879).

M. de Rossi gave a short resumé of his work, which is printed among the reports.‡

After a short discussion, in which MM. de Rossi, Palmieri, Cantoni, and Mascart took part, the Committee adopted the resolution given at p. 15.

The meeting closed at 1h. p.m.

E. Mascart, President.
v. Bezold, Secretary.

APPENDIX VII.

Report of the First Committee.

A. The Committee took points 8, 12, and 13 into consideration, and first discussed the question how, in the interval between this and the next Congress, the furtherance of common work in meteorology could be provided for. Two ways leading to this end were discussed: the establishment of a permanent international central institute, and the appointment of a committee, to hold office until the next Congress, and which should settle the necessary business by regular correspondence and, as often as requisite, by special conferences.

* "Nature," Vol. XV., p. 556, April 26, 1877.
† This note has never been received.
‡ Rapports sur les questions du Programme, p. 257.

The latter method appeared at the first glance as the most tedious. It must, however, be affirmed that it is not possible at present to create a permanent Central Institute, and, on the other hand, the experience gained between the time of the Vienna and the present Congress, has shown that a Committee whose members are spread even over the whole of Europe are able to co-operate satisfactorily in carrying out the decisions of the Congress, and in preparing and even executing meteorological investigations of a general nature.

The Committee thought, therefore, that they would promote the object best in proposing for the immediate future a similar organisation. By the help of the Committee, also, the discussion and publication of such works as require international support will be facilitated. The Committee, after deliberation, have adopted the resolutions which are now submitted for the approval of the Congress (*vide* p. 16).

For the execution of its functions the Committee will need certain funds, for which purpose the formation of an international fund was proposed in section 8 of the Programme; it was proposed that the countries taking part in the Congress should be called upon to pay a fixed contribution to this fund. Many members, however, declared that they had not received the sanction of their Governments to such an obligation, and as it had not been difficult hitherto to obtain the requisite funds by mutual agreement in each special case, it was preferred to refrain from making any resolution thereupon, and to leave it to the Committee to provide as hitherto for the reimbursement of their expenses in a similar way.—Resolution D., p. 17.

B. The Committee is of opinion that a new Congress should be convened after a maximum interval of five years.—Resolution B., p. 17.

C. With regard to the further proposals made in points 12 and 13, the Committee proposes the Resolutions A. and C. given at pp. 16 and 17 for the decision of the Congress:

(Signed) BRUHNS,
Secretary.

APPENDIX VIII.

REPORT of the SECOND COMMITTEE.

The second Committee had the following questions to consider:

Questions 4 and 5 of the Programme of the Permanent Committee with the proposals of MM. Hildebrandsson, de Brito-Capello, and Weihrauch.

A communication from M. Wojeikoff.*

The proposal of M. Pittei.†

Question 9 of the Programme of the Committee.

Question 15 of the Programme with the proposal of M. Hellmann.

Question 4.—With respect to the Report of M. Buys Ballot on the reduction of means of observations employed in the different countries to true means, the Committee proposes the resolution given at p. 20.

Question 5.—After a thorough discussion, the result of which was that the number of international stations indicated in the Utrecht report should be considered as a minimum, and in which the great difficulties which are opposed to the enlargement of the form were brought forward, and in taking into account also the proposals of MM. Hildebrandsson, de Brito-Capello, Mühry, &c., the proposal of the Committee was accepted in the form suggested by it (*vide* p. 20).

On the proposals of MM. Hildebrandsson and de Brito-Capello respecting the regular publication of observations of the direction of the upper clouds, and seeing their great importance, which has also been set forth by Captain Hoffmeyer, the Committee, considering the form adopted by M. Wild as the best, makes the proposal given at p. 22.

On the proposal of M. Weihrauch as to the great importance of having the data of the mean force of wind, the Committee, after having discussed this

* Rapports sur les questions du Programme, p. 253.
† Ibidem, p. 165.

matter by itself, as well as the form to be chosen for the publication of these data, adopted M. Weihrauch's proposal in the form given at pp. 20–21.

M. Wojeikoff, of St. Petersburg, has sent to MM. Hann and Hoffmeyer charts with isobars for the whole globe, together with explanatory text. After an exchange of ideas upon this interesting subject, and in accordance with the expressed desire of M. Wojeikoff. The Committee presents to the Congress the charts which M. Wojeikoff has sent representing the mean annual distribution of atmospheric pressure, and which are intended to form a part of a more extended work on the climate of the globe.

On the proposal of M. Pittei to publish an international dictionary of meteorology, and after a discussion as to the contents of this dictionary, the resolution given at p. 22 was adopted.

Question 9.—M. Hellmann proposes to add thereto a catalogue of books and papers on meteorological subjects.

After a long discussion, in which all the members of the Committee took part, communicating all the publications of this kind which are already at our disposal, the resolution given at p. 21 was adopted.

Question 15.—As to the establishment of rules and formulæ for reducing barometric readings to the sea level in a uniform manner.

M. Bruhns gave a brief summary of the results of the report which he had drawn up upon this question.*

M. Bruhns and other members then stated the difficulty met with in determining the mean temperature of the column of air comprised between the sea level and a station under consideration, which temperature is necessary for the reduction of the barometric reading to the sea level.

Upon this point M. Plantamour insisted that the barometric formulæ were not applicable when it was a question of isolated observations, the condition of the equilibrium of the atmosphere being realised only by means of a large number of observations.

The Committee, in conformity with the views of MM. Bruhns and Hellmann, adopted the resolution given at p. 22.

(Signed) Blaserna, President.
Hann, Secretary.

APPENDIX IX.

Report of the Fourth Committee.

First Meeting, 15th April, at 4h. p.m., under the Presidency of M. Neumayer.

The questions submitted to the 4th Committee were Nos. 6, 27, 28, 29, 31, and 35.

The President proposed the nomination of three sub-committees, but after some observations by MM. Mascart, Lorenz, and Scott, it was proposed by Captain Hoffmeyer that the whole of the questions should be treated by all the members of the Committee. This proposal was put to the vote and adopted.

The Committee then proceeded to discuss the different questions.

Question 6.—M. Pittei thought that the International Code, which was very useful for the exchange of telegrams between different countries, should be modified for national telegrams, as was in fact the case in Italy.

M. Mascart said that the discussion on question 6 might perhaps be referred more usefully to a future Congress, after preliminary experience, for at present in France, for instance, (and this country was perhaps not the only one,) the central office was occupied in putting the International Code into practice, in the form which was adopted at Utrecht, and it would be impossible for him, at least at present, to introduce any change.

M. Lorenz proposed, on the contrary, to discuss the question of improving the system of meteorological telegrams, adding, that it was for each Govern-

* Rapports sur les questions du Programme, p. 191.

ment to judge of the desirability of introducing the changes proposed by the Congress.

M. Pujazon recommended the Committee to adopt the following proposal:—

"The Committee recommends for general adoption the telegraphic code proposed at Utrecht."

After some remarks by MM. Pittei, Pujazon, Bruhns, and by Mr. Scott, who drew attention to the improvements proposed by MM. Hann and Rikatcheff, Captain Hoffmeyer observed that the different reports had only just been distributed, and the members had not had time to study them, and further, that these reports touched upon all the questions which were to be discussed. He therefore proposed as a principle that all the questions should be discussed twice, and Mr. Scott especially requested the adjournment of question 6.

Captain Hoffmeyer's proposal was adopted by six votes to five, the other members abstaining from voting. Mr. Scott's proposal was unanimously adopted.

Questions 27, 28, and 29 were likewise adjourned, as certain reports had only just been distributed, and also because of the absence of General A. J. Myer, who was expected.

Question 34.—Captain Hoffmeyer gave certain particulars relative to the construction of his synoptic charts, and said that the simultaneous observations were, in his opinion, still too few, and too unequally distributed for the purpose of undertaking synoptic charts; he would, further, try to introduce into his charts all possible improvements, and he finally requested that the question of synoptic charts, and of simultaneous observations, should not be mixed up, but treated separately.

Mr. Scott gave some information about the synchronous charts which had been constructed in England, about those of General Myer, and more particularly about those of Mr. Meldrum for the Indian Ocean.

MM. Mascart, Pujazon, and de Brito-Capello stated that in their countries simultaneous observations were, or were about to be, put into practice.

A vote was taken as to whether questions 29 and 34 should be separately discussed; and it was decided that they might be discussed together as circumstances required.

The Committee voted the adjournment of the discussion.

The meeting closed at 6h. p.m.

G. Neumayer.
Brault.
R. Müller.

Protocol of the Second Meeting, 17th April, at 4h. 30m. p.m.

President: M. Neumayer.

The protocols of the meeting of the 15th April were read and confirmed.

The President opened the discussion upon question 6 (the Telegraphic Code), and called upon Mr. Scott, who stated that he could not accept the conclusions of M. Hann's report. He was of opinion that at present nothing should be changed in the code proposed at Utrecht, and he thought that it would be preferable to leave to a future Congress the study of the improvements that might be introduced into it.

Captain Hoffmeyer supported this opinion, but he thought with M. Rikatcheff, that it would be very desirable that meteorological telegrams should contain also barometric and thermometric changes, &c.

M. Mascart thought that whatever modifications might be introduced, it would be more prudent at present to keep to the system actually in use.

Mr. Scott remarked that the meteorological reports would undergo a very considerable delay if the data desired by M. Rikatcheff were introduced.

M. Wild proposed the following resolution:—"The Congress is of opinion that "there is no occasion to change the present form of meteorological telegrams, "but it recommends to the directors of central institutions to take into con- "sideration M. Rikatcheff's proposal relative to the study of barometric and "thermometric changes, &c."

After some observations by MM. Pujazon, Pittei, Lorenz, and Hoffmeyer, M. Pujazon proposed the resolution given at p. 23.

Mr. Scott requested that the International Code should not be changed.

M. Pittei suggested an amendment to the proposal of M. Wild; instead of "but it recommends," to put "...and recommends to the Permanent Committee to study the modifications that it would be useful to introduce into it."

The President put the various proposals to the vote, and that of M. Pujazon was adopted.

Question 28 (Maritime Meteorology.)—Mr. Scott proposed the resolution given at p. 23.

Captain Hoffmeyer supported this resolution, which, after some remarks by the President and Mr. Scott, was adopted unanimously.

Mr. Scott proposed that the members interested in Agricultural Meteorology should meet privately to deliberate upon question 35.

The Committee decided that this meeting should take place in the evening at 8 o'clock.

The meeting closed at 6 o'clock.

G. Neumayer.
Brault.
R. Müller.

Protocol of the Third Meeting, on the 19th April.

The meeting opened at 3h. 30m. p.m. The protocols of the meeting of the 17th April were read and confirmed.

The President, in the first place, opened the discussion upon question 34 (Synoptic Charts), Captain Hoffmeyer having presented to him the following proposal upon this question:—

"The Congress is of opinion that a Monthly Synoptic Review of the "Weather of Europe, analogous to that published by the Chief Signal Office "of the United States for North America, would contribute greatly to the "advance of Meteorological enquiry, and for that reason it recommends such "a publication, on the understanding,—

"(1.) That such a publication could not be complete nor even possible "without the active co-operation of all the central institutes of "Europe, and the contribution of all their contingents of continental "and maritime observations.

"(2.) That, on the other hand, the necessary unity of method in the work "requires that all the materials should be collected and discussed "at the same place, or at least by institutions who have made an "agreement to work together on an uniform plan.

"(3.) That the Meteorological Institute of Copenhagen and the Deutsche "Seewarte of Hamburg have already published works of this nature "for several years, to wit, the Copenhagen Institute, the Daily "Synoptic Charts of Europe, and the Atlantic Ocean, and the "Deutsche Seewarte, a monthly resumé of the weather of Central "Europe."

"The Congress accepts the proposal made by these two institutions, to "undertake the publication of a monthly synoptic review of the weather and "invites the other central institutions of Europe to take steps for obtaining a "number of subscriptions proportionate to their respective positions, in order "to cover the material expenses of this publication."

M. Neumayer requested M. Wild to be good enough to take the chair during the discussion of this question, in which he wished to take part.

Captain Hoffmeyer offered some explanations upon different points of his proposal.

M. Neumayer stated that he was completely in accordance with Captain Hoffmeyer, and that he hoped that with time, and the improvements which he would introduce into this publication, the synoptic review would become more and more important.

M. Pujazon thought that the proposal under discussion, being within the province of the Permanent Committee, should not be dealt with by the Congress; he thought, however, the proposed publication was very commendable.

Mr. Scott stated that he had heard with pleasure the proposal made by MM. Hoffmeyer and Neumayer, and would do all that depended on him to assist in carrying it out.

M. Mascart declared that it was impossible for him to commit himself to an annual subscription in favour of this publication.

The proposal was put to the vote and adopted by the majority.

Question 29. (Simultaneous observations.) (M. Neumayer in the chair.)

Mr. Scott thought that the Congress might declare that it took great interest in simultaneous observations.

M. Hoffmeyer thought that simultaneous observations had not hitherto contributed very much to the advancement of meteorology; the cause of this was to be looked for in their almost total absence in arctic regions, and in the fact that they gave the conditions of the weather at a very late hour of the day in Europe. To enable them to be used in synoptic charts they must be developed in the sense of giving three equidistant observations in the 24 hours, and to be nearer to each other in northern countries.

M. Brault thought that the synoptic charts hitherto constructed, with observations taken at local times, were insufficient, and that it was time to introduce more precise charts into the science. It was from this point of view that simultaneous observations were of great importance. Synoptic charts, such as now drawn, were false in principle; they combined, by curves, observations made at intervals of one to four hours, and thus gave only a somewhat rough approximation of the state of the weather, a condition which simultaneous charts would give with precision. He hoped therefore that very soon simultaneous charts would replace synoptic charts, to the great profit of the science.

MM. Scott and Mascart made the proposal printed at p. 24, which was adopted unanimously:—

Question 35 (Agricultural and Forest Meteorology).—The President said that he was of opinion that question 35 was so important that the discussion of it could not be finished by this Committee, and he thought it would be necessary to convoke a special conference for it, similar to that of 1874, for maritime meteorology.

M. Lorenz, after having given some information as to the actual condition of Agricultural Meteorology, proposed to the Committee to submit the following resolution to the Congress:—

"In order to contribute to the progress of Agricultural and Forest Meteor-
" ology, the Congress recommends as a programme for study,—
" 1. The influence of the meteorological elements upon vegetation.
" 2. The inverse influence of vegetation upon the meteorological elements.
" 3. Agricultural warnings."

After several members of the Committee had taken part in the discussion upon this subject, the Committee unanimously accepted the resolution proposed.

M. Denza submitted the following resolution to the Committee:—

"The Congress, in view of the development that agricultural weather fore-
" casts have taken in many countries, and of the results obtained, supports the
" efforts of those who are occupied with these applications of meteorology, and
" encourages all those who propose to introduce this same service into countries
" where it has not yet been adopted, and where it is demanded by the public,
" provided that this be done with every precaution and without compromising
" the science."

MM. Tacchini, Wild, and Scott made some remarks upon this question. Owing to the lateness of the hour, the President proposed that the discussion should be adjourned to the next meeting, which was fixed for Monday, 21st April, at 2h. p.m.

G. Neumayer.
Brault.
R. Müller.

Protocols of the Fourth Meeting on 21st April.

The President opened the meeting at 2h. p.m.

The protocols of the meeting of the 19th April not yet being finished, the President was of opinion that the meeting of this day should be considered as a continuation of that of the 19th April, and he proposed the discussion of question 35.

Before the discussion was commenced Professor Smith made some remarks and proposals, seconded by M. Mascart, relating to question 31 (Synoptic Charts).

The President declared that it seemed to him impossible to be able to finish a fresh discussion to-day upon this question, and therefore he proposed to hold another meeting to-morrow morning.

This proposal was accepted.

M. Lorenz continued the reading of the details of his proposal (Question 35).

Mr. Scott requested that a phrase might be inserted in it, drawing attention the work of General Myer in relation to agricultural meteorology.

M. Pietti requested that the details of the proposal should be omitted. He shared the opinion expressed by the President at last meeting, and wished also that the question should be referred to a special conference.

Mr. Scott supported this idea, and requested, on the part of M. Hann, that the term "agricultural and forest meteorology" might be used.

M. Lorenz did not consider the addition of the word "forest" necessary, as it, in his opinion, was included in the general denomination of "agricultural meteorology."

M. Mascart, on the contrary, insisted upon this addition. After some remarks by M. Pittei, M. Wild, in accord with that gentleman, made the following proposal:—

"After having heard and discussed the reports of M. Lorenz upon this "subject, the Committee proposed to the Congress the adoption of the "following resolution (*vide* p. 24)."

The proposal was put to the vote and adopted unanimously.

After the President had remarked upon the great importance of the proposal, which appeared to be the sole means of solving, to the best advantage, the question of the application of meteorology to agriculture and the cultivation of forests, the meeting closed at 3h. 30m. p.m.

G. Neumayer.
Brault.
R. Müller.

Protocol of the Fifth Meeting, on 22nd April.

The President opened the meeting at 8h. 45m. p.m.

The Secretary read the protocols of the meeting of the 19th and 21st April.

After having heard Professor Smith's remarks upon the protocol of the meeting of the 19th, the Committee adopted the protocols, with the reservation of the following resolution proposed by M. Mascart, in accord with MM. Hoffmeyer and Neumayer, and which should be substituted for that previously adopted (*vide* p. 24).

This resolution was unanimously adopted.

The President asked whether M. Denza desired the discussion of his proposal of Saturday last (p. 78), upon which the latter did not insist.

The President declared that the Secretary had no time to make a detailed report upon the labours of the Committee. He proposed merely to give the different proposals and resolutions adopted by the Committee and to submit them in the general meeting of the Congress.

The Committee adopted this proposal and the meeting rose at 9h. 15m. a.m.

G. Neumayer.
R. Müller.

The protocol of the meeting of the 22nd April was read and confirmed by—

MM. Bruhns.	MM. Mascart.
Capello.	Müller.
Denza.	Pittei.
Hoffmeyer.	Scott.
Lorenz.	Wild.
	Neumayer.

(The other members of the Committee being absent.)

R. Müller.

APPENDIX X.

Report of the Fifth Committee.

First Meeting, Wednesday, 16th April, at 9h. a.m.

The meeting was opened by M. Denza, President.

Mr. Scott laid the following communications upon the table :—

1°. A letter addressed by himself to the French Aeronautical Society on the importance of meteorological observations in captive balloons ; and also the reply of the society, in which the latter stated that Mr. Scott's proposal had been entered among its agenda (Question 30).

2°. A letter from M. Parkinson, Samoan Isles, to M. Wild. (Question 32.)

3°. A letter from M. Hann to Mr. Scott on the importance of the observations on the motions and changes of existing glaciers. (Question 30.)

4°. A letter from Mr. Nichols and two letters from Mr. Freshfield, on the same subject. These gentlemen lead us to hope for the co-operation of the members of the London Alpine Club in the above-named researches upon glaciers.

5°. A printed letter from Mr. John Ball on the same subject.

6°. Letter from the Central Direction of the Austro-German Alpine Club to Mr. Scott, requesting instructions as to the manner of observing the motions and changes of glaciers.

M. Hann presented :—

1°. A letter from the Direction of the Austro-German Alpine Club upon glaciers.

2°. A work by M. Fritz upon the periodical changes in length of glaciers.

M. Hellmann communicated a letter from Mr. Knipping, of Tokio (Japan), containing information about several meteorological stations in Japan.

Mr. Scott presented to the Committee a copy of "Contributions to our Knowledge of the Meteorology of the Arctic Regions," published by the Meteorological Council of London, and stated that he hoped that this publication would be continued.

The Committee thanked Mr. Scott for this present, and requested him to convey its thanks to the Meteorological Council for this important work, and also expressed the hope that it would be continued.

The President announced the opening of the discussion upon the questions of the Programme entrusted to it by the Congress.

The Committee first decided to treat the two questions, 11 and 32, together, as referring to subjects differing very little from each other, viz. :

Question 11.—"The Committee draw attention to the importance of establishing distant stations and supplying them with the necessary instruments."

Question 32.—"In what manner shall we proceed to establish meteorological stations in distant countries where observations have not hitherto been made?"

Upon this latter question M. Mohn has published a scheme* and MM. Parkinson and Wild have made proposals.†

M. Hellmann also presented to the Committee a chart, upon which were traced in colours the countries of the globe for which observations have been published.

After a short discussion, M. Wild made the following proposal :—

Resolution A., p. 25.

This proposal was adopted by the Committee.

The letter from Mr. Parkinson to M. Wild was then read, in which Mr. Parkinson explained the desire of the Missionary Societies and of the Colonial Government of the Isles of Samoa, in the Pacific, to have several stations of the second order on the isles of the Archipelago. He offered to take the direction of the meteorological system, if provided with funds for this purpose.

The Committee did not think it could engage itself in this enterprise, and unanimously framed the following proposal :

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* Rapports sur les questions du Programme, p. 33.

† Ibidem, p. 46.

Resolution B., p. 25.

Mr. Scott stated that in 1878 meteorological instruments had been sent to Norfolk Island, and that a report upon all the existing meteorological data for the Isles of Samoa had been presented to the Meteorological Society of London, in March 1879.

M. Hann asked for information as to the condition of the meteorological stations in South Africa.

Mr. Scott informed the Committee that Mr. Gill, the new Director of the Cape Town Observatory, had commenced the re-organisation of the meteorological service at that observatory, and that the Kew Observatory would, during the next summer, undertake the comparison of the standard barometers of Kew and Cape Town.

Mr. Scott added that a scheme of meteorological observations and of storm warnings for the Antilles had been presented to the British Government, and that he hoped to see it carried out.

M. Neumayer also informed the Committee that he possessed a series of nine years' observations made at Norfolk Island, but that the instruments used for the observations had not been verified.

After the reading of M. Mohn's report on question 32, above mentioned, and after a long discussion, in which all the members of the Committee took part, M. Plantamour was requested to frame the definitive proposal, which was as follows :

Resolution C., p. 25.

This proposal was put to the vote and adopted.

The next meeting was fixed for Friday, the 18th, at 9h. a.m.

The meeting rose at 11h. 30m. a.m.

F. Denza, President.
Weyprecht, Secretary.

Second Meeting, Friday, 18th April, at 9h. a.m.

The meeting was opened by M. Denza, President. The protocol of the first meeting was read and confirmed. The discussion on questions 11 and 32 of the Programme was continued.

M. Mohn read the passages of his report (*see* the protocol of the preceding meeting) relative to the choice of instruments for distant stations.

At the request of Captain Hoffmeyer, a discussion was opened on the use of barometers. The great difficulties in the transit of mercurial barometers during long overland journeys was admitted.

M. Wild drew attention to the mercurial barometers which could be filled at the place of observation; and M. Tacchini mentioned in this respect the barometer of M. Uzielli.

The President observed that according to his own experience this barometer did not give accurately the tenths of millimetres.

It was agreed that this method of filling barometers during journeys was not safe, at least with the instruments we possessed at present, and that they could not be used without fear of error.

Captain Hoffmeyer requested information as to the reliance which could be placed upon aneroid barometers.

A detailed and interesting discussion ensued upon this subject between all the members of the Committee, from which the use of aneroids in journeys, and especially for the measurement of altitudes, was decided against, and it was admitted that at the utmost these instruments might be adopted exceptionally for observations at fixed and very distant stations, but always after having been compared with mercurial barometers.

M. Neumayer recommended the boiling-point thermometer for the determination of heights of mountains. The Committee, however, while acknowledging the utility of this instrument, especially in the hands of experienced observers, did not think its employment altogether safe and free from error.

The President opened the discussion upon question 26 of the Programme viz., " Have, since the last Congress, hourly meteorological observations been made at new, and especially Continental, stations within the Tropics." (See Report of the Fourth Commission, protocol of the sixth meeting of the Con-

gress of Vienna, and its first supplement.) Mr. Blanford had presented a report upon this subject.*

The President requested Mr. Scott to give a resumé of Mr. Blanford's report above referred to, after which the resolution A, p. 26, was framed and adopted.

Mr. Scott brought to the knowledge of the Committee a communication from the Government of Brazil, in which the latter asked for an expression of opinion from the Congress as to the utility of a system of meteorological stations over the territory of that empire. This communication was welcomed with interest by the members of the Committee, who adopted resolution B., p. 26.

Mr. Scott drew attention to the proposal of Mr. J. Allan Broun, of the Trevandrum Observatory, who urged the continuation of the publication of observations made at his observatory.

Mr. Scott stated that this publication had been interrupted because the local Government had not granted the funds necessary for the purpose.

Mr. Plantamour thought that a subscription might be raised, but this proposal was not supported by the majority of the members.

After a short discussion, resolution C., p. 26, was framed.

The Committee adjourned to Monday, 21st April, at 4h. p.m.

The meeting closed at 11 o'clock.

F. Denza, President.
Weyprecht, Secretary.

Third Meeting, Monday, 21st April, at 4 p.m.

The meeting was opened by the President.

M. Weyprecht, the secretary, read the protocol of the second meeting, which was adopted.

He then presented the following proposal in the name of M. Schenzl :—

"There is no meteorological station at present beyond the eastern and southern frontier of Hungary. It seems to me, therefore, very desirable that the Congress should designate Bulgaria, Roumelia, Roumania, and Servia among the countries where the establishment of meteorological stations is declared to be important; as to Bosnia and Herzegovina, it should be remarked that the Central Meteorological Office of Vienna has already established meteorological stations of the third order there, and that consequently it would not be difficult to complete them."

After this communication, the President proposed to add the following resolution to those already adopted in reply to questions 11 and 32 :—

Vide Resolution D., p. 26.

The President opened the discussion upon question 30 of the Programme.

"What observations do we possess from high mountains, and from balloon ascents, and what measures should be taken to organise these observations more completely."

MM. Hann† and Denza‡ have presented reports upon this question.

The President invited M. Hann to read the first conclusion of his report.

M. Hann read this conclusion.

M. Plantamour thought that it was impossible to determine accurately at the same time, the height of the balloon and the pressure of the air, owing to the influence which the ascensional motion of the balloon must exert on the barometer and thermometer.

M. Hann remarked that it was only in balloons that the influence of the ground could be eliminated, which was impossible at mountain stations, at whatever height they might be situated. He recommended observations in balloons as well as those at elevated stations.

M. Hoffmeyer recommended the comparison of observations made in balloons with those entered on synoptic charts.

M. Hann thought that the question should not be looked at from such or such particular point of view, but that the observations could only be analysed for the object which each investigator proposed in his researches.

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* Rapports sur les questions du Programme, p. 77.
† Ibidem, p. 53.
‡ Ibidem, p. 127

M. Wild remarked that observations of this nature could only be utilised upon condition that they were published in detail. He therefore proposed to add to the first proposal of M. Hann the recommendation that observations made in balloons should be published *in extenso*.

This proposal of M. Wild was adopted, and the Committee finally decided that the vote of thanks that M. Hann had added at the end of his proposal should be suppressed. After this modification, M. Hann's proposal read as follows:—

Resolution A., p. 26.

M. Hann read the first part of the second proposal of his report, which was adopted without discussion, viz.: Resolution B*a*, p. 26.

Upon this subject the President remarked that in a few years the Direction of Italian Meteorology would publish *in extenso* all the meteorological observations of the stations of Valdobbia (8,360 feet), Stelvio (8,343 feet), and Little St. Bernard (7,087 feet), which are the most elevated among the Italian Alps.

M. Hann withdrew the second part of the second proposition, thanking several meteorologists who have established elevated stations (*see* Reports, p. 69). He then read the third part of his proposition, which was adopted without discussion:—

Resolution B*b*., p. 26.

M. Hann read the fourth part of the second proposition (Reports, p. 69).

A prolonged discussion ensued upon this subject among the members of the Committee.

MM. Plantamour, Scott, Denza, and Wild drew attention to the difficulties which observers placed on the summit of mountains had to combat, viz., snow, winds, the complete isolation of the observers, and also the curiosity of tourists during the fine season.

M. Snellen proposed to erect self-recording instruments at elevated stations, and to transmit their indications to a lower station by electric wire. This proposal was not adopted, because several members remarked that the maintenance would be very difficult, if not impossible, and that on the other hand, it could not remain long without attention.

The President said it would be impossible to establish meteorological stations on the summits of the Italian Alps, which were inaccessible during winter; and even in the fine season there was difficulty in reaching them. He thought, therefore, that the Committee should confine themselves to recommending for these mountains elevated stations, and even very elevated, although they were not placed quite upon the summits. Moreover the stations might also render great service to meteorology.

M. Plantamour reported to the Committee that he had been charged by the Swiss Government to communicate to the Congress that that country would be disposed to contribute to the establishment of stations on the summits of high mountains, but that it could not bear the whole cost of them.

He proposed the summit of Hohe Väntis in the canton of Appenzel as best situated, but he drew attention to the enormous expense which would have to be incurred to establish a good meteorological station at that place, and he concluded that contributions from other countries would be indispensable.

As the article of the Programme in which the Permanent Committee proposed the formation of an international fund had been rejected, the Committee did not think it could undertake such a proposition.

Ultimately M. Wild and other members proposed to modify the fourth part of the second proposal of M. Hann, in the following manner:—

"The Congress, while recognising the sacrifices which the Government of Switzerland has already made for meteorology generally, recommends the Swiss Society of Natural Sciences to do its utmost to promote the establishment of an observatory upon one of the high summits of Switzerland and other countries, &c."

This proposal was adopted provisionally, for the members of the Committee having other pressing engagements, the discussion was adjourned by the President until the next meeting, which was fixed for Tuesday, 22nd April, at 10h. a.m.

The meeting rose at 5h. 30m. p.m.

F. Denza, President.
Weyprecht, Secretary.

Fourth Meeting, Tuesday, April 22nd, at 10h. a.m.

The meeting was opened by the President, at 10h. a.m.

The Secretary read the protocol of the third meeting, which was confirmed.

The discussion on the fourth part of the third proposal of M. Hann was continued.

M. Snellen desired that this part should be modified, especially the part respecting Switzerland.

MM. Wild and Plantamour expressed the same desire.

The President requested M. Hann to read again the proposal in question, which was done.

The President drew attention to what he had stated in his report, viz., the great difficulty there was in finding, in the chain of the Italian Alps, an elevated and quite isolated peak, suitable for taking regular and continuous observations. He thought, therefore, that the Congress should approve also the establishment of mountain stations, as well as those already existing, provided that the circumstances are not altogether unfavourable for meteorology, and that the observations are made during the whole year.

Eventually the fourth part of M. Hann's second proposal was altered as follows :—

Resolution Bc., p. 27.

This proposal was adopted.

M. Hann read the fifth part of his second proposal (*see* Reports, p. 69).

The President brought to the knowledge of the Committee the scheme of M. Parenti for establishing a meteorological observatory on the summit of Mont Cimone, in the Appenines of Modena. He presented the printed programme of M. Parenti, and the plan of the observatory building, and at the same time stated that this would be the most favourable place available in the Italian mountains for the establishment of a meteorological station which would satisfy all the conditions desired by the Committee and by the Congress also.

Captain Hoffmeyer withdrew the recommendation that he had made in the second part of the proposal under discussion.

After some other less important remarks, the following proposal was framed :—

Resolution Bd., p. 27.

M. Tacchini thanked the Committee for the desire it had expressed respecting the observatory on Mount Etna, and presented to the members the plan of the building for the new station. He assured the Committee that the works would be begun next summer.

M. Hann read the third proposal of his Report (*see* Reports, p. 70).

The President repeated that for some years the Direction of Italian Meteorology had published *in extenso* a large part of the observations which were made at the three high meteorological stations of the Great and Little Saint Bernard and of the Stelvio.

M. Hann's proposal was adopted without alteration, viz. :—

Resolution C., p. 27.

The President declared the discussion on question 31 of the Programme open, viz. :—

"31. The Committee, after having taken cognizance of the project of M. Weyprecht to establish several observatories in the Arctic and Antarctic regions, so as to organise hourly meteorological and magnetical observations to be made simultaneously all around the Pole, are of opinion that those observations will be of the highest importance in developing meteorology, and in extending our knowledge of terrestrial magnetism. They think, therefore, that, in the interest of science, they should recommend general participation in this enterprise. In what manner can the Congress, on its part, contribute to the success of the enterprise? "

MM. Buys Ballot* and Mohn† have drawn up reports on this question.

M. Weyprecht presented :

1°. A Note to the Royal Meteorological Society of Utrecht.

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* Rapports sur les questions du Programme, p. 17.

† Ibidem, p. 29.

2°. A Speech read at the 48th Assembly of German Naturalists and Doctors at Prätz, 18th September, 1875: "Fundamental Principles of Arctic Exploration."

3°. Programme of Operations for an International Polar Expedition proposed by Count Wilczek and Charles Weyprecht.

The President called upon M. Weyprecht, who stated that three years ago Count Wilczek and he had formed the intention to undertake a scientific expedition to the northern coasts of Nova Zembla, for which Count Wilczek would furnish the necessary funds. The object of this expedition would be primarily to make continuous meteorological, magnetical, and hydrographical observations, and also observations on the Aurora Borealis during an entire year.

In order that these studies should be satisfactory and conclusive, synchronous observations were necessary at different points of the Arctic and Antarctic regions. For this reason an attempt has been made to promote other small expeditions. Experience, however, had shown that it was a task too serious and difficult for private persons.

But not being able indefinitely to postpone the execution of this scheme, M. Weyprecht asserted that he had decided to start upon the expedition next year, 1880.

With this object in view, Count Wilczek and he asked the Congress:

If it would undertake to provide for the sending out of other simultaneous expeditions, or if it could arrange that after a year another expedition should take the place of the first, in order to continue the observations commenced for another year. M. Weyprecht remarked, in conclusion, that if the proposed expedition should remain isolated, they would adhere rigorously to all the details of the programme of operations already proposed and presented to the Congress. If, on the contrary, they could hope to have certain and definite promises before the end of next September, which were indispensable for the choice and fitting out of the vessels, M. Weyprecht, in the name of Count Wilczek, undertook to postpone the expedition for a year longer, viz., until 1881, and he declared also that he was disposed to submit the proposed programme for discussion.

After this communication a discussion ensued between the members of the Committee.

M. Neumayer thought that Antarctic regions should be included also in the scheme, and that it would be desirable to create a colonial direction for the *advanced* stations to be established for polar meteorology, and he proposed stations at the islands of Kerguelen and Auckland, and perhaps a station of the second order at Punta Arenas.

He desired that the Congress should recognise the necessity of Antarctic meteorological researches, and he announced that he was authorised by the German Government to make this recommendation; and that from the year 1880 the latter would be disposed to allow him to undertake observations in the Antarctic regions by placing at his disposal a vessel of the Imperial Navy.

M. Wild, while acknowledging the importance of Antarctic explorations, thought that, for the purpose of attaining the end proposed, we should not undertake too many things, but that for the present it would be indispensable to confine ourselves to simultaneous observing stations in the Arctic regions, of which he admitted the great utility.

M. Hann withdrew the fourth proposal of his Report (*see* reports, p. 70).

M. Bruhns affirmed that with this object use could advantageously be made of the meteorological and magnetical observations of Chili and of Melbourne. He thought that the Committee should express its opinion on this matter. He considered, however, that Antarctic researches should also be included in proposal 31 of the Programme.

M. Mohn was of the same opinion; he thought that Arctic and Antarctic studies should progress at the same time.

M. Plantamour said he did not understand the great meteorological importance that high northern regions might have for the climate of Europe.

M. Neumayer drew attention to the great importance which local circumstances in southern latitudes have upon the climatology of the globe.

M. Hoffmeyer inquired whether the Congress could accept in its Programme studies upon terrestrial magnetism. He thought the Congress ought to occupy itself especially with meteorology.

M. Rubenson reported that a committee had been appointed in Sweden to study this question.

MM. Wild, Mohn, Scott, and Denza also thought that magnetic observations should be carried out together with meteorological observations, especially in the actual question, for advantage should be taken in every way of Polar expeditions, which are certainly not too frequent.

Several members then remarked that they had no definite instructions upon this question.

After other remarks and propositions by various members, it was ultimately decided to frame the resolution given at p. 28 :

The resolution was adopted.

The meeting was adjourned until 3h. p.m.

The President closed the meeting at noon.

F. Denza, President.
Weyprecht, Secretary.

Fifth Meeting, Tuesday, 22nd April, at 3h. 45m. p.m.

This meeting should be considered as as a continuation of the morning meeting.

The Committee discussed the question about glaciers proposed by M. Hann to the Permanent Committee (*see* Report of the Permanent Committee, the First Meteorological Congress of Vienna, meeting at Utrecht, 1878, p. 2), and upon which several communications, mentioned at the first meeting of the Committee, had been presented to the Congress.

After a short discussion, the Committee adopted the resolution given at p. 27.

The President then declared the discussion of the questions referred to the Committee closed.

The President afterwards read all the resolutions which had been framed by the Committee, in order to correct them and to prepare them for presentation to the Congress.

The meeting rose at 4h. p.m.

F. Denza, President.
Weyprecht, Secretary.

APPENDIX XI.

Questions.	Resolutions.
1. Regulations for the Second International Congress of Meteorologists, prepared by M. Bruhns.	Adopted at the first meeting (p. 1).
2. Report of the Committee on its action during the interval between the First and Second Congress, prepared by Mr. Scott.	Read at the first meeting of the Congress (p. 2).
3. Report on the conformity with each other, and with the decisions of the Congress of Vienna, of instruments, methods of observation, and publication of observations in the different countries.	The Congress decides that the English report mentioned by Mr. Scott be translated into French and German and published as Appendix V. to the Report of the present Congress. At the same time it requests the future Committee to make such a report for the next Congress respecting the conformity of the methods, &c. with the decisions of the Congresses of Vienna and Rome (p. 9).
4. M. Buys Ballot is requested to prepare a report on the methods employed in the different countries for obtaining true daily means from the various combinations of hours of observation.	The Congress proposes that each country be invited to establish at a certain number of points, regard being paid to local conditions, stations at which continuous observations should be made by means of self-recording instruments, or else hourly observations during several term-days in each month, or lastly continued, equidistant, and frequent observations (eight times a day at least), in order to obtain the necessary data for reducing to true means the means of observations made twice or thrice a day at ordinary stations (p. 20).
5. The Committee proposes the general adoption of the forms of publication already introduced in several countries for observations at a certain number of stations of the second order chosen in each country as international stations. (See the Reports of the Committee for 1873 and 1874, p. 9, third meeting at Utrecht, and Appendix F.)	The Congress adopts proposal No. 5 in the form in which it has been proposed by the Permanent Committee (p. 20). The monthly and yearly results published by the central offices for the different stations, contain, in accordance with the resolutions of the Congress of Vienna, a summary of the frequency of the eight principal directions of the wind, both for the months and for the year. Seeing the importance which must be attached, not only to the direction but also to the *force of the wind*, the Congress proposes (in accordance with M. Weilhrauch's proposal) to publish also in these summaries the *mean force* of each wind, and for the greatest possible number of stations for each month and for the year. Where the form adopted allows sufficient space, the figures representing the frequency and the mean force should be placed side by side; otherwise it is preferable to give both in the form of an appendix (p. 20). The observation of the direction of the upper clouds, and especially of cirrus, at some stations of each country, and the publication of these observations in the form of an appendix, is strongly recommended (p. 22,) and also the publication of observations on the temperature of the surface of the ground. (Question 18) (p. 23).
6. The Committee recommends the general adoption of the code of figures for meteorological telegrams proposed at its fourth meeting at Utrecht. (See the above Reports, pp. 12 and 14.)	Adopted.—See question 27.
7. The Committee is of opinion that it is impossible at present to compile general instructions adapted in their details to the special peculiarities of all countries and all climates. It proposes, therefore, that the Congress should confine itself, in the case of any one demanding typical instructions, to designating those of the existing instructions which are most conformable to the decisions of the Congress.	The directors, whose names are given in the following list, announced that their instructions were in general conformity with the regulations of Vienna:— MM. v. Bezold - Bavaria. Houzeau - Belgium. Hoffmeyer - Denmark. Scott - - England. Mascart - France. Neumayer - Germany (Deutsche Seewarte). Snellen - Holland. Cantoni - - Italy. Mohn - - Norway. Capello - - Portugal. Wild - - Russia. Bruhns - - Saxony. Aguila - - Spain. Rubenson - Sweden. Planta-Reichenau - Switzerland (p. 6).
8. The Committee proposes to establish, by small annual contributions from all countries taking part in the Congress, an international fund, for the expenses incurred by such joint undertakings as those named in the following sections, and the expenses of postage and printing for the Congress and its Permanent Committee.	The Congress resolves not to carry out the eighth proposal of the Programme, namely to establish a small international fund by means of small annual contributions by all the countries taking part in the Congress (p. 17).

Questions.	Resolutions.
9. The Committee requests the delegates to prepare for the Congress at Rome a catalogue of the meteorological observations, both published and unpublished, in their respective countries. M. Hellmann proposes to add thereto a catalogue of meteorological works and memoirs. M. Pittei proposes the publication of an International Meteorological Dictionary.	The Congress states with pleasure that very valuable preliminary works corresponding to article No. 9 of the Programme and to M. Hellmann's proposal have been already partly executed; but as it is to be desired that these materials should be collected in a general catalogue, The Congress proposes that these publications be divided into two categories :— 1°. A catalogue of series of observations. 2°. A catalogue of meteorological works and memoirs. As to the first category the directors of the different meteorological systems are invited to prepare catalogues of the published and unpublished observations in their respective countries, and to inform the International Committee of the work already done in that direction. As to the second catagory, the Congress is of opinion that the works already done by Professor Cleveland Abbé, and the catalogues already printed of the library of the Meteorological Society of London, and of the Observatory of Brussels, might well serve as a starting point for more comprehensive publications, and invites all the directors of other meteorological libraries to add the list of works and memoirs which are not yet entered in these catalogues (p. 21).
10. The Committee proposes to have a comparison made of the standard barometers and thermometers of all the meteorological institutes by referring them to a certain barometer and thermometer, which for the time being, appear to be the best verified. Inasmuch as the International Office of Weights and Measures of Paris will be in possession of such verified standard instruments, a comparison should be instituted with them, and they should serve as a basis for all corrections. At the same time any questions about accurate height above sea level of standard barometers should be raised.	The Congress is of opinion that it would be very useful that an international dictionary of meteorology should be published (p. 22).
11. The Committee draws attention to the importance of establishing distant stations and supplying them with the necessary instruments.	The Congress recommends the directors of all central institutions to have their instruments compared with the standard instruments of other countries (p. 12).
12. The Committee is of opinion that the establishment of an international meteorological institute is at present not possible, nor even desirable, and proposes to provide for the functions and labours which might devolve upon such an institution in the following manner: (*a.*) The international administrative functions, such as the execution of the decisions of the Congress, the convening of future Congresses, the care of joint international investigations and undertakings, the administration of the international fund, &c., will be confided, as is already partly the case, to a *Permanent Committee* elected from time to time by a Congress, and required to give an account of its action to the next Congress. (*b.*) As regards researches which embrace a considerable portion of the globe, for the purpose of deducing general laws in meteorology, it is desirable that permanent relations for the communication of materials should be established between the different central institutes, and that the publications appearing in each country should be distributed gratuitously to all institutes and to all persons who take part in the investigations. These publications are to be, moreover, rendered generally accessible through the agency of booksellers. These international investigations will be based upon the publication of the	The Congress expressed the opinion that the cost of establishment and maintenance of distant stations should not be borne by an international fund, but at the expense and under the care of the countries which are in relation with those localities (p. 25). The Second Meteorological Congress assembled at Rome institutes an *International Meteorological Committee*, which is charged with everything that concerns international relations until the meeting of a future Congress. The Committee is composed of nine members elected by ballot, under the restriction that two delegates of the same country cannot hold seats on it at the same time. In case of vacancy by the resignation or by the death of one of its members, the Committee may complete itself by the co-option of a new member, having regard to the restriction above indicated. The Committee elects its own executive officers and distributes its labours among the different members. The Committee is charged with the publication of the Report of the present meeting in three languages, English French, and German (p. 29). With seeing that the decisions of the Congress are carried out, with the convening of future Congresses, with the preparation of the questions which should be submitted to this Congress, with the keeping of the delegates to the present Congress informed of its proceedings and of its decisions, and lastly, with the presentation to the next Congress, at the expiration of its functions, of a report embracing the whole of the period (p. 16). The Congress is of opinion that a new Congress should be convened after a maximum interval of five years* (p. 17).

* Note.—The Committee elected by the Congress was composed of the following members: MM. Buys Ballot, Cantoni, de Brito Capello, Hann, Maseart, Molm, Neumayer, Scott, Wild. At its first meeting M. Wild was elected president and Mr. Scott secretary. It was further arranged that the Committee should give timely notice of all its meetings to meteorologists interested in its proceedings (p. 29).

Questions.	Resolutions.
observations of each country according to the international form, and, besides, on the special labours which each country may be willing to undertake with regard to its own climate. In the case of supplementary information being required for any countries it is desirable that a suitable system of reciprocal communications should be devised.	
13. The Committee considers the following subjects as possessing a general interest: (*a.*) Critical collection and discussion of all existing data on the diurnal range of air temperature, and attempts to deduce general laws therefrom. (*b.*) Critical collection and discussion of all existing data on the diurnal and annual range of absolute and relative atmospheric humidity, and attempts to deduce general laws therefrom. (*c.*) Critical collection and discussion of all data on the diurnal and annual range of the state of the sky, that is, of the amount of cloud. (*d.*) Wind tables for the 12 months and for the year. (*e.*) Tables of precipitation for the 12 months and for the year. (*f.*) New tables of atmospheric pressure, with isobars, for the 12 months and for the year. (*g.*) Charts of the movements of storm. (*h.*) Daily synoptic charts, embracing considerable portions of the globe.	As regards researches which embrace a considerable portion of the globe for the purpose of deducing general laws in meteorology, it is desirable that permanent relations for the communication of materials should be established between the different central institutes, and that the publications appearing in each country should be distributed gratuitously to all institutes and to all persons who take part in the investigations. These publications are to be, moreover, rendered generally accessible through the agency of booksellers. The Congress considers the subjects enumerated in question 13, among others, as possessing a character of general interest. The directors of the central institutions are invited to have these works executed as soon as possible for the stations of their respective countries and published, in order that they may serve as a basis for researches which may be undertaken on the general march of meteorological phenomena over the surface of the globe. Before undertaking the investigation of any one of the above-mentioned subjects, the public establishments are invited to acquaint the President of the International Committee of their intention, and he will inform the directors of all the central institutions (p. 17).
14. The Committee proposes to organise, in connexion with the Congress at Rome, an exhibition, as complete as possible, of the instruments of observation used in the different countries, and it requests meteorologists to contribute thereto by sending either instruments or designs to Rome.	The Congress expresses the opinion that it is desirable that the central institutions should possess specimens of the principal instruments actually in use in other countries (p. 28).
15. The Committee recommends the establishment of rules and formulæ for reducing barometric readings to the sea level in a uniform manner. Supplementary proposition by Dr. Hellmann to prepare a new set of tables for reduction.	(1.) The reduction to the sea level by the addition of a constant quantity during the whole year is only admissible for heights not exceeding 20 metres, if we wish to obtain an accuracy of ± 0·5 mm. (±0·002 in.). Consequently, for stations situated at a height exceeding 20 metres, account must be taken of the temperature and approximately of the relative humidity, according to Laplace's method. (2.) In weather reports it is desirable that the barometric readings unreduced should be given by the side of the readings reduced to the sea level; in other publications it is *necessary* to have in all cases unreduced readings. (3.) It is desirable that the International Meteorological Committee should undertake the compilation of fresh uniform tables for the reduction of barometric readings to the level of the sea. (4.) It is equally desirable that the Committee should undertake the preparation of a collection of tables which may be employed in the meteorological systems of the different countries (p. 22).
16. The Committee proposes the establishment of uniform rules for determining the fixed points of thermometers.	The Congress is of opinion that the method indicated in M. Pernet's report on the determination of the fixed points of thermometers should be provisionally accepted (p. 12).
17. Can definitive rules now be established for the most suitable exposure of thermometers destined to give the temperature of the air?	The Congress, without actually prescribing a fixed form of thermometer screen suitable for different climates, and even for the exigencies of observers, draws the attention of meteorologists to the reports and communications presented to the Congress, either as printed papers, or in the protocols of the meetings of the Committee (p. 12).
18. Have additional comparative experiments been made since the first Congress for forming an opinion of the different methods for determining earth temperature, which give more definite information as to their relative value? M. Wild's proposal relating to observations of the surface temperature of soil.	The Congress has not been informed of any new experiments made on this subject since the date of the Vienna Congress, and in conformity with M. Wild's suggestion, proposes to admit the temperature of the surface of the earth among the meteorological elements to be observed at stations of the second order (p. 13).
19. Have decisive experiments been made since the first Congress to find a simple and appropriate method for determining radiation, and what is the relation between this and the amount of aqueous vapour in the atmosphere?	The Congress finds that the researches into the subject of radiation are not yet sufficiently advanced to enable it to propose a method of observation, and considers that the question should be referred to the next Congress (p. 13.)

Questions.	Resolutions.
20. What progress has been made in methods for determining the humidity of the air?	The Congress recommends the employment, as far as may be possible, of a regular arrangement for ventilation in the determination of the humidity of the air by means of the dry and wet bulb thermometers (p. 13).
21. What progress has been made in the methods of determining evaporation?	The Congress points out that atmometers generally should fulfil certain conditions of comparability, and expresses the opinion that there is need of fresh researches being undertaken, for the determination of the form and exposure of the instruments to be employed (p. 13.)
22. Is there any reason to change, after further experience, the decisions of the first Congress respecting the instruments and methods for measuring the quantity of rain or snow?	The Congress thinks, that for stations of the second and third order, a diameter of eight or even of four inches is sufficient for the rain gauge. As to the position of the rain gauges the Congress confines itself to recommending that they should never be placed upon a roof, but that they should be sufficiently elevated to be out of the influence of drifting snow, and of the splashing of drops from the ground, while they must not be sheltered by trees or other neighbouring objects (p. 13).
23. How many absolute values of the velocity of the wind be deduced from the direct indications of different anemometers?	The Congress does not feel itself prepared at present to reply to the question of the determination of wind velocity. It confines itself to recommending the directors of central institutions to effect a comparison between the anemometers employed in different countries (p. 14). If the future International Committee finds that the question is sufficiently advanced, it is to propose an international comparison of anemometers (p. 14).
23*a*. M. Hildebrandsson's proposal for the observations of "cirrus" clouds.	The observation of the direction of the upper clouds, and especially of cirrus, at some stations in each country, and the publication of these observations in the form of an appendix is strongly recommended (p. 22).
24. Have since the last Congress better methods been discovered for measuring the ozone in the atmosphere?	The Congress thinks that the difficult question of the determination of ozone does not in its present condition permit of a definite solution (p. 15).
25. What progress have the methods for determining atmospheric electricity made, and what results have observations of this kind furnished hitherto?	The Congress is of opinion that the study of atmospheric electricity has made marked progress in recent years, and recommends that a comparison should be made between the instruments which are most generally used. (p. 15.)
25*a*. Proposal of M. de Rossi for observations of earthquake phenomena.	After having heard with interest the Report of M. de Rossi on the phenomena which he comprises under the term "Endogenous Meteorology," the Congress expresses such desire to see such researches continued and insists upon the relations which may exist between them and those of general meteorology (p. 15). A. The Congress expresses the desire that the hourly observations made at the existing tropical stations may be continued, and that other analogous observatories may be established, especially in the interior of the continents of the Torrid Zone. B. The Congress, recognising the great importance that meteorological stations in Brazil would possess for the progress of science, begs the Italian Government to make this desire known to the Government of that country. C. The Congress decides upon conveying to the Royal Society of London their expression of the importance it attaches to the continuation of the publication of the observations made at Trevandrum by Mr. J. Allan Broun, and upon requesting that Society to be good enough to take steps to this effect (p. 26).
26. Have, since the last Congress, hourly meteorological observations been made at new, and especially continental, stations within the tropics? (See Report of the IVth Commission, Protocol of the Sixth Meeting of the Congress of Vienna, and its First Supplement.)	
27. What progress has meteorological telegraphy made since the first Congress, and how can we contribute to its development?	The Congress recommends for meteorological telegrams the general adoption of the code of figures proposed by the Permanent Committee at Utrecht, and states that the Report which has been presented by Mr. Scott to the Congress on the present condition of meteorological telegraphy contains some information with reference to question 27 (p. 23).
28. What progress has maritime meteorology made since the First Congress?	The Congress expresses the opinion that the Maritime Conference at London in 1874 has fulfilled the conditions prescribed by the Congress of Vienna for the study of maritime meteorology; it is of opinion also, that in order to ensue the future progress of this branch of meteorology the most perfect liberty should be accorded to the institutions interested in making mutually the arrangements which are most suitable for the execution of their investigations (p. 23).
29. What results have the simultaneous observations given, and how may we contribute to their further development?	The Congress is of opinion that the development of simultaneous observations contributes greatly to the progress of meteorology, and that all work done in this direction should be encouraged (p. 24).
30. What observations do we possess from high mountains and from balloon ascents, and what measures should be taken to organise these observations more completely?	A. The Congress, recognising the importance that observations made in balloons, especially at places situated in the interior of the continents, may have for the physical study of the higher regions of the atmosphere, recommends the taking of observations of temperature and humidity by means of captive balloons, and according to Glaisher's method, in strata at different heights, and on different days and in different seasons. It recommends also the study, by means of captive balloons, of the diurnal range of temperature and humidity in the upper strata of the atmosphere and the detailed publication of these observations (p. 26).

Questions.	Resolutions.
	Ba. The Congress thinks that it would be very useful if observatories could possibly be established on the summits of mountains, and the observations published *in extenso*, so that they may be placed at the disposal of all meteorologists, and may aid in the solution of problems which may present themselves in future (p. 26).
	Bb. The Congress insists upon the utility of a series of hourly observations of temperature, pressure, direction and force of wind, and eventually also of humidity on Mount Washington, and especially at Pike's Peak, the highest station upon the earth. This series should embrace one year at least; and it would also be desirable to publish in detail the observations already existing for these two stations. General Myer is requested to be good enough to realise these desires of all meteorologists (p. 26).
	Bc. The Congress recommends the Swiss Society of Natural Sciences to do its utmost to promote the establishment of an observatory upon one of the high summits of Switzerland. It expresses the desire that meteorological stations may be established under similar conditions in Italy and other countries (p. 27).
	Bd. The Congress considers the establishment of the observatory of Etna, proposed by M. Tacchini, of that of Mont Cimone, proposed by M. Parenti, and that of Mont Ventoux, supported by the Meteorological Commission of the Department of Vaucluse, as enterprises of high scientific importance (p. 27).
	C. The Congress requests the directors of the meteorological systems of the various countries to be good enough to publish in a complete manner the existing series of observations made at elevated stations, and which have either not yet been published, or only in an incomplete manner; and at the same time to indicate and describe the stations of their systems which might furnish materials for the study of the upper regions of the atmosphere (p. 27).
30*a*. Proposal by M. Hann for the measurement of the variations in length of glaciers.	The Congress draws the attention of meteorologists to the importance of measuring the variations in length and thickness of the glaciers in the different countries in order to be able to deduce the relations which exist between these variations and those of the meteorological elements. As a means of extending our knowledge upon this question the Congress recommends:— To form a complete critical collection of observations made in times past upon the variations of volume of the glaciers. To institute in future continued observations at localities suitably chosen, upon the annual variations of the glaciers in length and thickness and to publish the results. The Congress hopes to be able to rely upon the co-operation of the Alpine Clubs and other analogous societies in carrying out these researches (p. 27).
31. The Committee, after having taken cognizance of the project of M. Weyprecht to establish several observatories in the Arctic and Antarctic regions, so as to organise hourly meteorological and magnetical observations to be made simultaneously all around the Pole, is of opinion that those observations will be of the highest importance in developing meteorology, and in extending our knowledge of terrestrial magnetism. It thinks, therefore, that, in the interest of science, it should recommend general participation in this enterprise. In what manner can the Congress, on its part, contribute to the success of the enterprise?	The Congress recognises the great importance which should be attributed to synchronous meteorological and magnetical observations made in the Polar regions by means of simultaneous expeditions, and it recommends all Governments to give the most effective support to such undertakings. Considering— 1°. That the majority of the members of the Congress are not provided with instructions relating to this question; 2°. That such instructions are absolutely necessary in order to arrive at definite resolutions. The Congress decides to entrust the International Committee with the convening of a special Conference, which should be composed of delegates provided with the necessary instructions and powers by their Governments, who may think they could participate in some way with the enterprise. By reason of the preparations already made by M. Weyprecht and Count Wilczek for an expedition of this nature, it thinks it necessary that this Conference should meet at Hamburg on the 1st of October 1879, in order to settle the details of the scheme and the means of carrying it out (p. 28).
32. In what manner should we proceed to establish meteorological stations in distant countries where observations have not hitherto been made? *Vide* Question 11.	The Congress cannot give effect to the proposal of Mr. Parkinson, who has asked for funds for organising a meteorological service in the Samoa Islands, because it has no international fund at its disposal; but with regard to the importance of this proposal, it expresses the hope that private initiative will permit of meteorological observations being taken in the Samoa Islands (p. 25). The Congress considering,— 1°. That it is of the highest importance that the meteorological stations established by different countries in parts of the globe, which are very remote and difficult of access, may be visited from time to time, in order to ascertain the accuracy of the instruments and of the amount of confidence which can be placed in the observations.

Questions.	Resolutions.
	2°. That such an inspection may be most conveniently made by officers of the navies of the maritime powers,
	Proposes to forward to the Governments of the countries represented at the Congress the request that they will kindly take the necessary steps that, on the one hand, the officers commanding vessels visiting those parts may receive instructions, in pursuance of which they would place themselves in communication with the observers at those meteorological stations, whatever be the nationality of the latter, for the purpose of comparing the instruments, and of acquainting themselves with the manner in which the observations are made; and on the other hand, that the observer charged with the care of the station may place himself at the disposal of the officer visiting it, whatever be the maritime power by which he is commissioned (p. 25).
	The Congress recognises that the establishment of meteorological stations in Bulgaria, Roumania, and Servia, would be of the highest importance, and it begs the Italian Government to cause this wish to be communicated to the Governments of those States (p. 26).
33. Should we not recommend the general adoption of a certain first meridian, for example, that of Greenwich, for synoptic charts?	The Congress recommends the adoption of the meridian of Greenwich as a starting point for the construction of synoptic meteorological charts (p. 11).
	In the event of another meridian being used in the construction of meteorological charts, the Congress recommends that an indication should be given upon the chart of the difference of longitude between the first meridian adopted and the meridian of Greenwich (p. 11).
34. In what manner can we best organise and develop the construction and publication of synoptic charts embracing considerable portions of the globe?	A proposition made by MM. Hoffmeyer and Neumayer for combined work on a uniform plan on the preparation of the synoptic charts of M. Hoffmeyer and of the monthly review of the Deutsche Seewarte at Hamburg having been submitted to the Committee and discussed by it, the following resolution was adopted:
	The Congress fully appreciates the importance of the publication which the meteorological institutes of Copenhagen and Hamburg propose to undertake, and it hopes for the realisation of this project (p. 24).
35. How can the development of meteorology in connexion with agriculture and forestry be forwarded by the Congress?	In order to contribute to the progress of agricultural and forest meteorology, the Congress recommends as a programme for study—
	1°. The influence of the meteorological elements upon vegetation.
	2°. The inverse influence of vegetation upon the meteorological elements
	3°. Agricultural warnings.
	The Congress, finding the subject too important to take a detailed resolution at this meeting, proposes to charge the International Committee with the convening of a special international conference before next spring, to take into consideration the development of agricultural and forest meteorology (p. 24).

APPENDIX XII.

List of Reports presented to the Congress.

Those marked * are printed either in full or in abstract in "Rapports sur les Questions du Programme."

Those marked thus † were also printed privately, and were distributed at the Congress.

Those marked thus ‡ have been published independently of the Rapports.

Articles of the Programme.

4. Sur la Réduction des Moyennes des Observations en vraies Moyennes.—Prof. Buys Ballot.*†
8. On the Proposal for the Establishment of an International Fund.—Prof. Bruhns;*† Prof. Wild.*†
9. On the proposal for a Catalogue of Meteorological Publications.—Prof. Wild;*† Dr. Hellmann.‡ (1)
10. On the Comparison of Standard Instruments.—Prof. Wild;*† Dr. Neumayer.†
11. On the Establishment of Distant Stations (see Art. 32).
15. On Tables for Reducing Barometrical Readings to Sea-level.—Prof. Bruhns;*† Prof. Wild;*† Prof. Hann (see Art. 27); Dr. Hellmann.‡(2)
16. On the Determination of the Fixed Points of Thermometers.—M. Pernet.*†‡ (3)
17. On the Exposure of Thermometers.—Mr. Buchan;‡(4) Prof. Cantoni;*†(5) M. de Brito Capello.*†
18. On Earth Temperature.—Prof. Ebermayer;*† Prof. Wild.*†
19. On Solar Radiation.—M. Violle;*† M. Marié Davy.*
20. On Atmospheric Humidity.—Prof. Cantoni.*‡(5)
21. On Evaporation.—Prof. Cantoni;*‡(6) Prof. Ebermayer.*†
22. On Rain-gauges.—Prof. Mohn.*†
23. On Anemometry.—M. de Brito Capello;*† Prof. Wild.*†
24. On Ozone.—Prof. Palmieri.*
25. On Atmospheric Electricity.—Prof. J. D. Everett*†‡(7); Padre F. Denza.*
26. On Hourly Observations between the Tropics.—Mr. H. F. Blanford.*†
27. On Weather Telegraphy.—Mr. R. H. Scott*†‡(7); Dr. J. Hann*†‡(8); Dr. C. Pittei*; M. Rikatcheff.*†
28. On Maritime Meteorology.—Mr. R. H. Scott*†‡(7); Dr. G. Neumayer*†; Dr. C. Pittei*; M. Rikatcheff.*†
29. On Simultaneous Observations.—Prof. Buys Ballot.*†
30. On Observations at Mountain Stations and in Balloons.—Dr. Hann‡†; Padre Denza.*
31. On Stations in the Arctic Regions and M. Weyprecht's plan.—Prof. Buys Ballot*†; Prof. Mohn*†; Dr. Neumayer†; M. Weyprecht.†
32. On Distant Stations.—Prof. Mohn*†; Prof Wild.*†
33. On the Choice of a First Meridian.—Prof. Bruhns.*†
34. On Synoptic Charts.—Capt. Hoffmeyer*†; M. Brault.*†
35. On Agricultural Meteorology.—Dr. Lorenz von Liburnau*†; Prof. Bruhns*†; Padre Denza.*

Additional Propositions.

On the Isobars of the Globe for January and July.—Dr. Woeikoff.*†
On the Importance of a Meteorological Dictionary.—M. C. Pittei.*
On Endogenous Meteorology.—Prof. E. De Rossi.*†
On the Observations of Cirrus Clouds.—Prof Hildebrandsson.*†

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(1) Zeitschrift der Oest. Met. Gesellschaft, vol. XIV., page 94.
(2) Ibidem, page 97.
(3) Ibidem, page 130.
(4) "Nature," vol. XV., page 556.
(5) Meteorologia Italiana, 1878. Memorie et Notize, fasc. 4, page 51.
(6) Ibidem, page 67.
(7) Published by the Meteorological Council, London.
(8) Zeitschrift der Oest. Met. Gesellschaft, vol. XIV., page 82.

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36. Report of the Proceedings of the Meteorological Congress at Rome, 1879. 1*s.* 6*d.*
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NON-OFFICIAL.

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